THE IRON AGE

THURSDAY, OCTOBER 9, 1890.

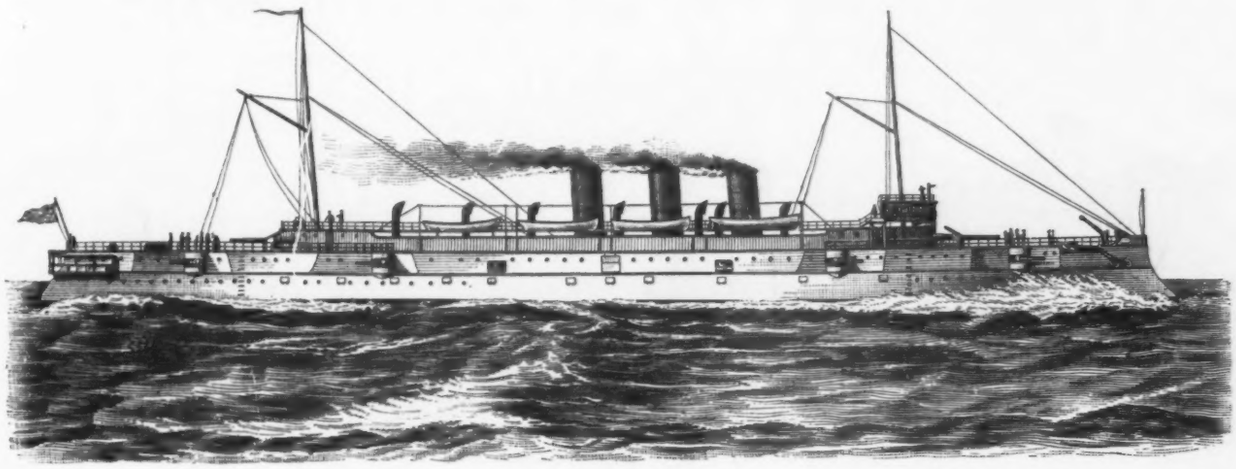
Triple-Screw Steel Protected Cruiser No. 12.

[*With Supplementary Sheet of Engravings.*]

On Wednesday of last week the Navy Department received bids for the building of three battle ships and one high speed protected cruiser. These boats show the wonderfully rapid strides which the department has made during the last few years, since they represent a stage in marine engineering more ambitious than was even hoped for by the strongest advocates of our so-called new navy. Further than this they may be considered as representing the capabilities of the shipbuilding industries of the country, especially in the appliances for the making of armor plate such as is here called for. That these boats will be completed in accordance with the specifications and that they will fulfill the requirements there can be no doubt.

In the act of Congress authorizing their construction the cost of each of the battle ships was limited to $4,000,000, exclusive of armor and armament, and the cost of the protected cruiser was limited to $2,750,000, exclusive of armament. The contract for the construction of two of the battle ships and the cruiser has been let to William E. Cramp & Son, of Philadelphia, the price for the battle ships being $3,020,000 each, and for the cruiser $2,725,000. The recommendation of the Cramps that the length of the boat be increased 12 feet was accepted. The Secretary of the Navy has also informed the Union Iron Works, of San Francisco, that the contract for one of the battle ships will be awarded to them provided they are willing to take the work for $3,180,000, that being the price at which the Cramps offered to build one vessel, plus $190,000 allowed for transportation.

The protected cruiser, of which we herewith present very full drawings of the most important features, is the first vessel built upon this side of the Atlantic which contains three screws, driven by three independent triple-expansion engines. Although this form of propulsion has been tried in Europe, there is still considerable doubt as to the exact advantages gained, and it therefore becomes evident that the experiment on the part of the Government will be watched with exceeding interest in naval circles of both this country and Europe. Great credit for the design of this boat is due to Chief Constructor T. D. Wilson, Naval Constructor Philip Hichborn, Engineer-in-Chief Geo. W. Melville, and Chief Engineer N. P. Towne. Since the protected cruiser is primarily intended to be a commerce destroyer, capable of driving from the sea or destroying the swiftest passenger steamer afloat, high speed and great coal endurance are the chief qualities aimed at. Her builders, therefore, will have to guarantee a speed of 21 knots, and in order to stimulate them a premium of $50,000 will be paid for each quarter knot she may make in excess of this on a four hours' trial, so that if she reaches a speed of 22 knots an hour, her builders would receive a premium of $200,000. A penalty of $25,000 will be exacted for each quarter knot below the 21 knots stipulated. The battle ships are to be heavily armored, and will each mount four 13-inch guns and four 8-inch guns, in addition to large secondary batteries of rapid-firing machine guns. They must obtain an average speed of 15 knots per hour in a four-hour trial, and for each quarter knot in excess of this a premium of $25,000 will be paid, the penalty being of like amount. All these boats are to be completed within three years from the signing of the contract.



TRIPLE-SCREW STEEL PROTECTED CRUISER, No. 12, U. S. NAVY.

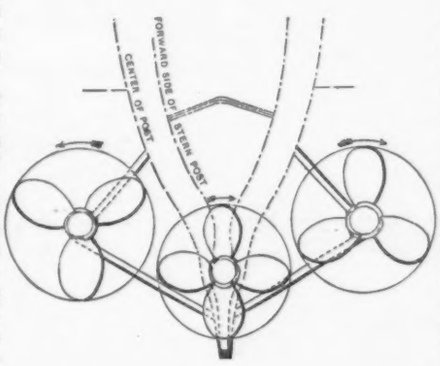


Fig. 13.—View of Stern, Looking Forward.

THE HULL OF THE CRUISER.

The principal dimensions of the cruiser are :

Length on load line	400 feet
Beam (extreme)	58 feet
Draft (mean, normal)	23 feet
Draft (extreme, normal)	24 feet
Displacement (at 23 feet mean)	7,400 tons
Coefficient of displacement	0.485
Speed (sustained)	21 knots
Speed (maximum)	22 knots
I. H. P. (estimated, sustained)	20,000
I. H. P. (estimated, maximum)	23,000
Coal supply	2,000 tons
Number of screws	3
Outboard screws in diameter	13 feet 9 inches
Center screw in diameter	12 feet

All the steel entering into the construction of this vessel must comply with the specifications approved by the Secretary of the Navy September 1 last. The flat keel plates are in two thicknesses, the outer plate being of 25 pounds and the inner of 22½ pounds to the square foot, this being reduced at the ends to 22½ and 20 pounds respectively. These are to be worked in lengthwise, as long as practical, and the butts to be planed and fitted in the most careful manner metal to metal; each thickness to have treble riveted straps of the same thickness as the plates and to be 16½ times the diameter of the rivets in width. The edges of the inner thickness are to be single riveted to the outer thicknesses. The vertical keel is of steel plate 20 pounds to the foot, and is in depth 42 inches. Forward and aft it is to be well connected to the stem and stern pieces, and made continuous throughout. The stem is of cast steel formed in two pieces, with the scarf in the neighborhood of the load line. The stern post is to be of the best hammered iron or cast steel, as approved, and to be shaped as outlined on the drawings. The forward portion is to be bossed out for the reception of the middle shafting. The frame of the rudder is to be of cast steel or best hammered wrought iron, as may be selected, the side plates to be of steel 15 pounds to the foot, the space being filled in with white pine.

From frame 29 to frame 82, or the space occupied by the machinery, the framing is to be 4 feet between centers, while forward and abaft these lines it is to be 3½ feet. The outside plating is to be 25 pounds to the square foot on the outer flat keel, and 22½ pounds to the foot on the inner flat keel plates, except at the

ends, where they will be reduced as stated. The remaining strakes of plating up to the outer deck stringer will be 22½ pounds to the foot. The sheer strake on each side from between frames 20 and 21 and frames 85 to 86 to be double, of 22½ pounds to the foot. Forward and abaft these points to be 30 pounds to the foot. Above the protective deck the plating will be flush jointed, single riveted at the edges, the breadth of edge strips to be seven times the diameter of the rivet. For a length of from 140 to 150 feet on each side of the vessel amidship the sheer strake and strake next below it will be fitted with triple riveted butt straps. All the strakes of the inner bottom are to be of 12½ pounds to the foot. There will be worked on the top of the beams for the whole length and breadth of the vessel, except under the gracis plates, where it will be worked as shown on the drawings, two courses of plating of 51 pounds to the square foot, or 1¼ inches thick. These form the protective deck plating. On the slope from frame 29 to frame 82 on each side an additional course 1¼ inches thick will be worked. The platform plating will be 10 pounds to the square foot. The armor protection to the 4-inch guns is to be 4 inches thick, and that to the secondary battery guns 2 inches thick, and the broadside machine guns will have plate armor 2 inches thick.

The conning tower, located on the superstructure deck, is to be of forged steel, 5 inches in thickness, and having a clear diameter of 8 feet. This is to be forged if possible in one piece, and secured to the foundation plates by angle bars. The towers are to be fitted with a top cover 1½ inches thick.

Extending from frame 29 to 63, and in hight from the vertical keel to the platforms, protective, and gun decks is a center line bulkhead and passage 2 feet wide in the clear and between the forward engine rooms is a center line bulkhead. On each side below the protective deck are formed double bulkheads abreast the boilers. These, together with the transverse bulkheads, form separate water tight compartments for the machinery, which is protected by the side coal bunkers. Compartments are formed forward and abaft the machinery space and between the inner and outer shells of the hull.

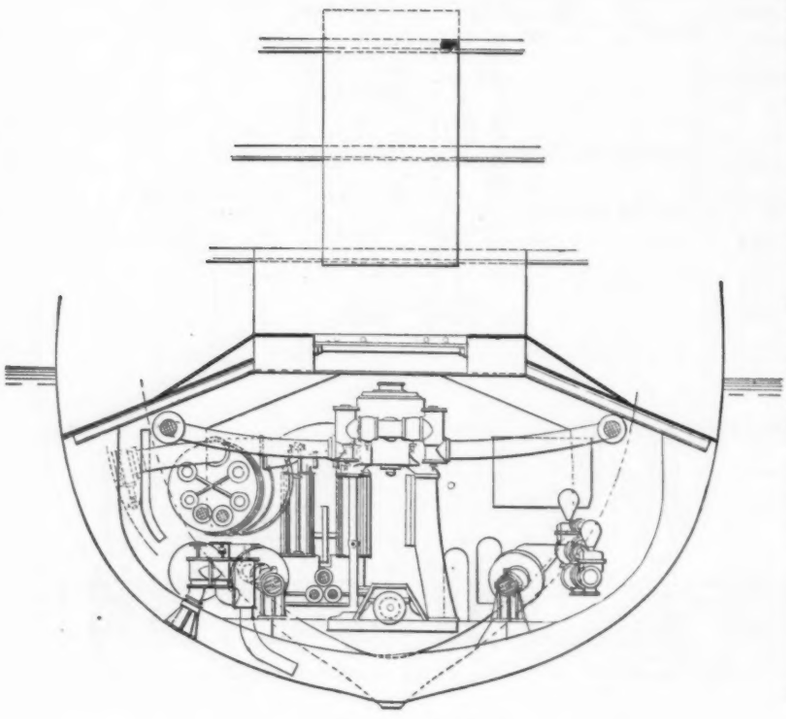


Fig. 4.—Transverse Section at Frame 83.

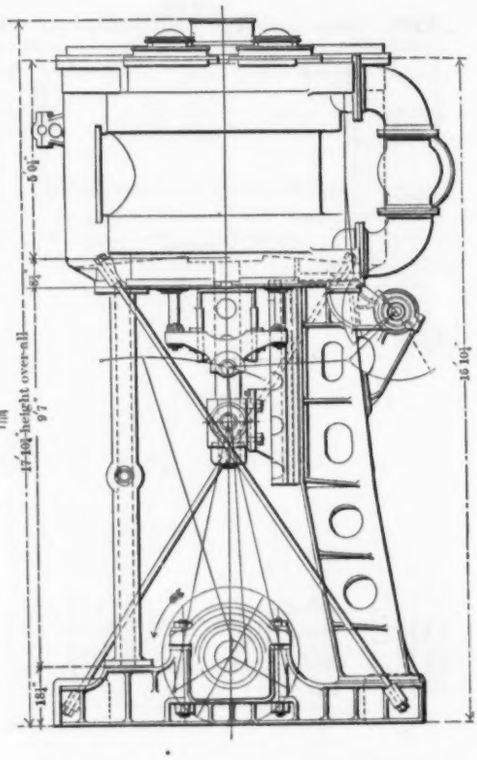


Fig. 8.—End Elevation of Starboard Engine, Looking Aft.

From the specifications we take the following general description of

THE MACHINERY.

There will be three sets of propelling engines, each set being complete in all respects and placed in separate water tight compartments, as shown on the drawings, Figs. 2 and 3. The amidship engine will be placed abaft the port and starboard engines. The amidship and starboard engines will turn right and the port one left handed when the vessel is going ahead. These engines will be of the vertical inverted cylinder, direct acting, triple expansion type, each with a high pressure cylinder 42 inches, an intermediate pressure cylinder 59 inches and a low pressure cylinder 92 inches in diameter—the stroke of all pistons being 42 inches. It is estimated that the collective indicated horse-power of propelling, air-pump and circulating pump engines should be about 21,000, when the main engines are making about 129 revolutions per minute. The high pressure cylinder of the after engine will be forward and the low pressure cylinder aft, and the high pressure cylinder of each forward engine

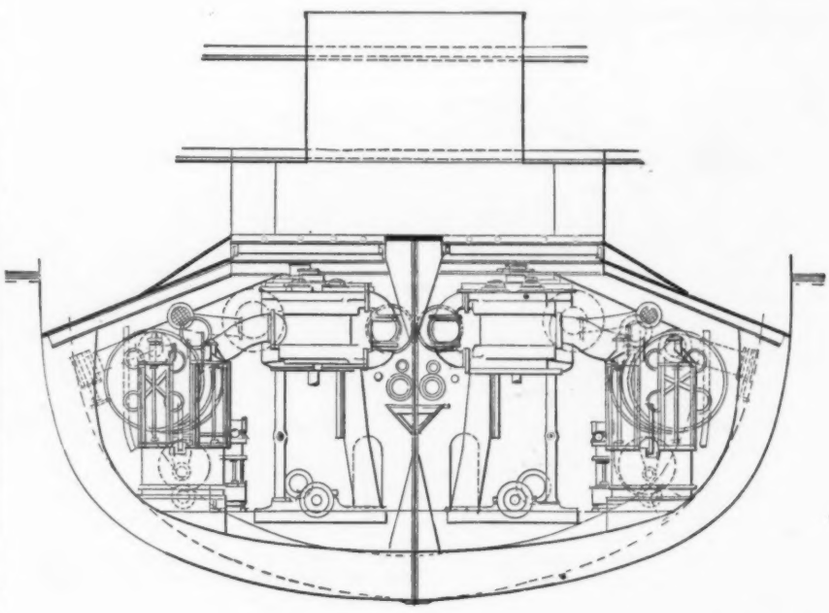


Fig. 5.—Transverse Section at Frame 72.

will be aft and the low pressure cylinder forward. The main valves will be of the piston type, worked by Stephenson link motions with double bar links. The alve gear of the intermediate pressure and low pressure cylinder will be interchangeable. There will be one piston valve for each high pressure cylinder, two for each intermediate pressure cylinder and four for each low pressure cylinder. Each main piston will have one piston rod, with a cross head working on a slipper guide. The framing of the engines will consist of cast steel inverted Y-frames at the back of each cylinder and cylindrical forged steel columns at the front, as shown in Figs. 7 to 10. The engine bed plates will be of cast steel, supported on wrought steel keelson plates built in the vessel. The crank shafts will be made in three interchangeable and reversible sections. All shafting will be hollow. The shafts, piston rods, connecting rods and working parts generally will be forged of mild open hearth steel.

The condensers will be made of composition and sheet brass, one for each propelling engine. Each main condenser will have a cooling surface of about 9474 square feet, measured on the outside of the tubes, the water passing through the tubes. For each propelling engine there will be a double vertical, single acting air pump worked by a vertical simple engine. The main circulating pumps will be of the centrifugal type, two for each condenser, worked independently. Two of the propellers will be right and one left, to be made of manganese bronze or approved equivalent metal.

Each engine room will have an auxiliary condenser, made of composition and sheet brass, of sufficient capacity for one third the auxiliary machinery, each condenser being connected with all the auxiliary machinery. Each of these condensers will have a combined air and circulating pump.

There will be six double ended boilers, Fig 9, about 15 feet 6 inches diameter and 21 feet 3 inches long, and two about 11 feet 8 inches diameter and 18 feet 8½ inches long for the main boilers, and two single ended auxiliary boilers about 10 feet diameter and 8 feet 6 inches long. The boilers will be of the horizontal return fire tube type, all constructed of steel for a working pressure of 160 pounds per square inch. The main boilers will be placed in four water tight compartments, and the auxiliary boilers on the protective deck, as shown on the drawings. There will be three athwart-ship fire rooms in each of the main boiler compartments. Each of the double ended boilers, 15 feet 6 inches diameter, will have eight corrugated furnace flues, 3 feet 3 inches internal diameter; each of the double ended boilers, 11 feet 8 inches diameter, will have four corrugated furnace flues 3 feet 6 inches internal diameter, and each single ended boiler will have two furnaces 2 feet 9 inches internal diameter. The total heating surface for the main and auxiliary boilers will be about 43,272 square feet, measured on the outer surface of the tubes.

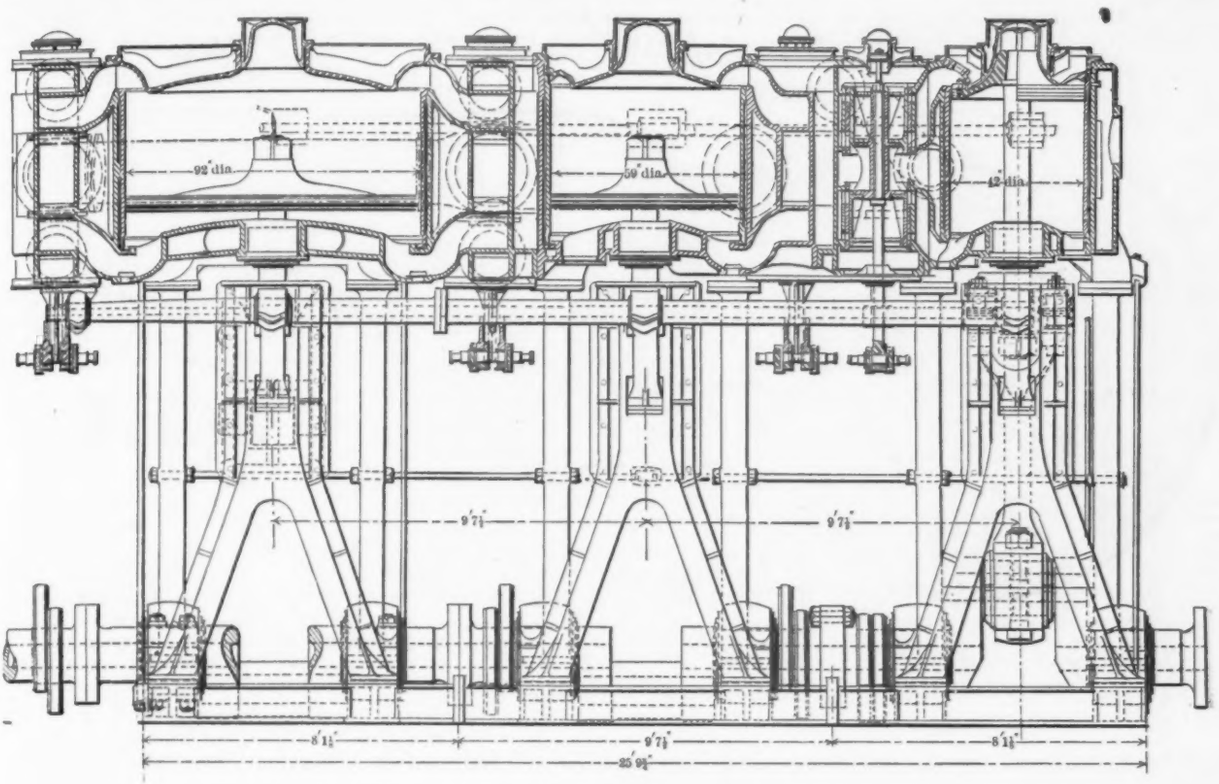


Fig. 7.—Elevation of Starboard Engines.

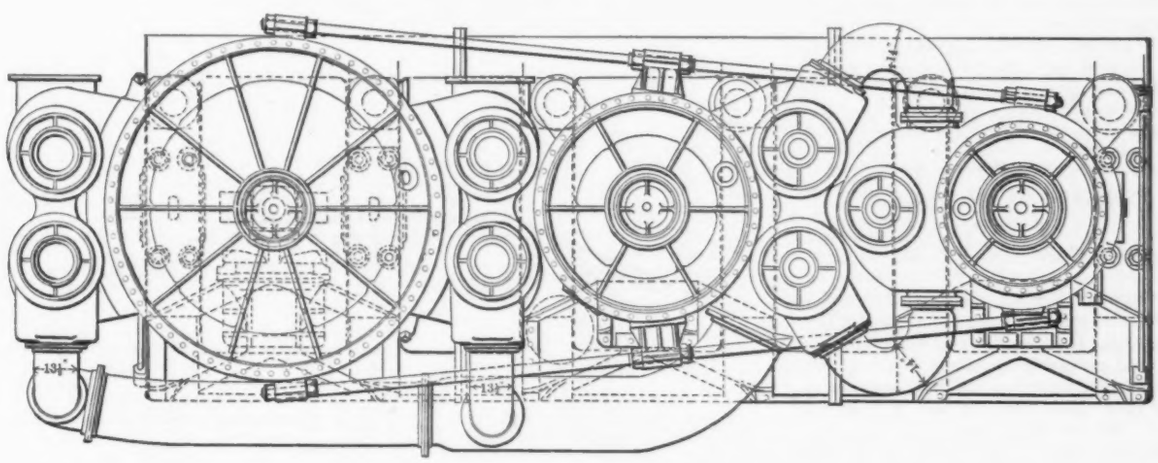


Fig. 10.—Plan View of Starboard Engines.

and the grate surface 1285 square feet. There will be in each fire room in which the check valves are placed an approved main and an approved auxiliary feed pump, and in each engine room an auxiliary feed pump. There will be three smoke pipes.

The forced draft system will consist of one blower for each fire room, discharging into an air tight fire room. Air-tight bulkheads will be fitted, so as to reduce the space to be maintained under pressure.

There will be steam reversing gear, ash hoists, turning engines, auxiliary pumps, engine room ventilating fans, engine for work shop machinery, evaporators and distillers, and such other auxiliary or supplementary machinery and tools as may be required.

The three screws and their shafts will be arranged as shown in Figs. 11, 12 and 13.

The normal supply of coal will carry the vessel 9840 knots, or 41 days steaming at 10 knots. The full coal supply of 2000 tons will give the vessel a radius of action of 26,240 knots, or 109 days steaming at 10 knots per hour.

The armament will consist of four 6-inch and eight 4-inch breech loading rifled guns as the main battery, and 12 6-pounder rapid firing guns, and six machine guns as the secondary battery.

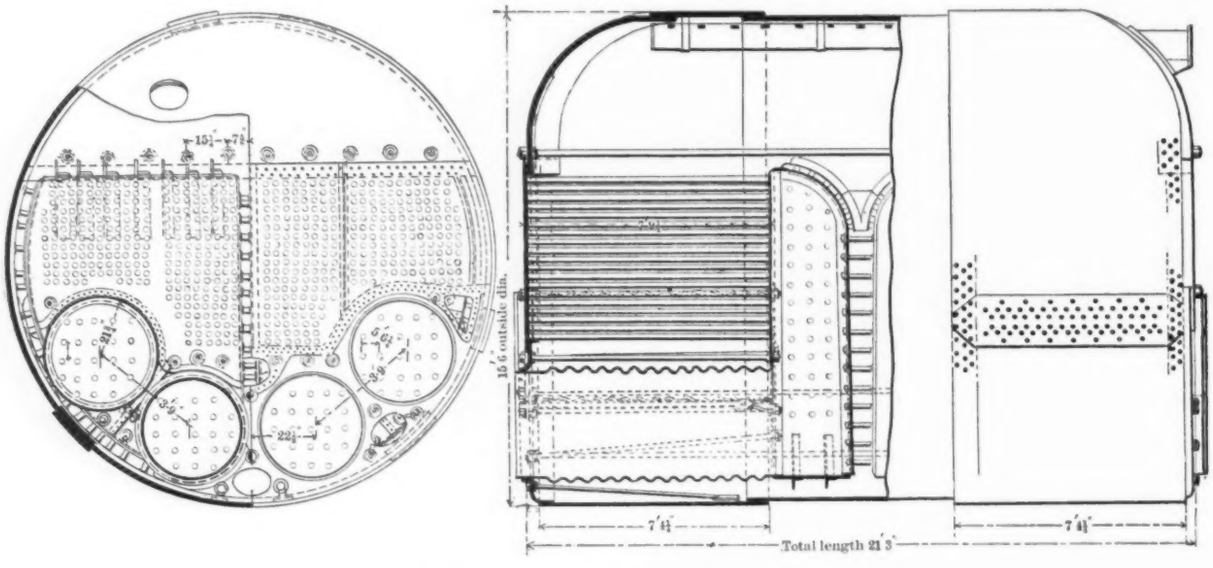


Fig. 9.—Elevation and Section of Boilers.

Triple Screw Propulsion.

BY HORACE SEE, NEW YORK.

There is no subject upon which such a diversity of opinion exists as that of screw propulsion. He who designs a propeller or system of propulsion is likely to meet with more adverse criticism on his scheme of work than the poor Indian did on his canoe. In the latter case this was confined to the shape of the boat, but in that of the screw propeller the shape is only one of a great number of subjects to be criticized. These multiply and become more complicated by the addition of each screw.

It is fortunate that the United States Government is coming forward to make an experiment with triple screws, as it is far better able to suffer loss if the effort is not a perfectly successful one than the merchant or the builder.

In building this experimental vessel they may not attain what is expected, but are sure to secure a vessel which will be a valuable addition to the navy, as there are many advantages to be gained by the use of the three screws, even if the hight of extreme speed calculated upon is not reached.

The speed of a war vessel varies with the condition of the service in which she is engaged. To-day at full speed, to overtake or escape an enemy, or to-morrow at an easy jog, while making a tour of duty where time is no object. In the first case the end must be attained at any cost, but in the last at the least.

The engine is built to secure the primary object—extreme speed. This means with the use of the single screw a reduction of revolutions at low speed, and with it a proportionate increased coal consumption per horse-power employed per hour. It is possible with twin screws to improve on this, either by duplicating the engines on each shaft, discontinuing the forward set when low speeds are desired and running the after ones at full speed, or by running the port or starboard engines separately at full speed.

With triple screws we can go still further than this. By their use the speed can be cut down in two ways, either by running the middle screw alone or either one of the outside screws separately at full speed. The idea of running the middle screw separately has governed the adoption of the triple system in the 7300 ton cruiser to be built for our navy. Some points, however, in their application to this vessel are open to criticism. We refer to the position and diameter of the middle screw. If in dropping this screw the shaft is inclined

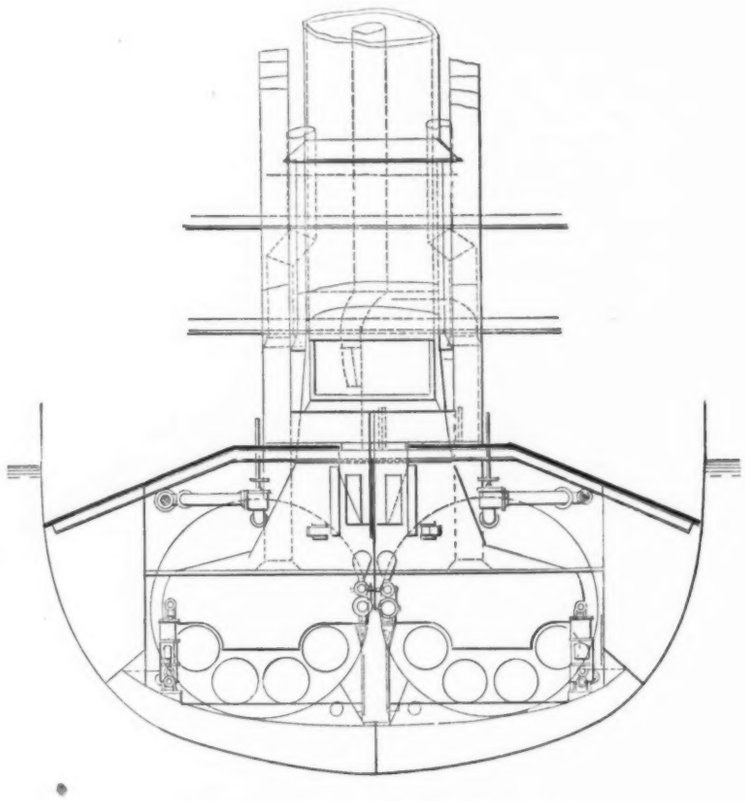


Fig. 6.—Transverse Section at Frame 54.

its pitch will vary through every part of its revolution in proportion to the amount of inclination. Consequently its action will be irregular and the speed of the ship retarded. By making the middle screw less in diameter than the outer ones we will have this vessel of 7300 tons displacement propelled, if the engine is worked up to its full natural draft power, by a 12-foot screw to which about 5000 indicated horse-power will be applied. This will no doubt act with some loss of efficiency and consequent waste of fuel, so that the end aimed at will be but partly secured. If, however, it is correct to employ such a small diameter here, it is all wrong in the merchant practice to employ a 16 or 17 foot screw to do work of a similar character.

The rivers of our country, on account of shallows in some places, present a field for the use of the multiple screw as great as that on the ocean, so that we shall await with some interest the building and trial of this vessel.

NEW ENGLAND NOTES.

The entire stock and fixtures of the Troy Machine Company, of Fall Rixer, Mass., were sold at auction September 30.

The framing floor at the Bath Iron Works, at Bath, Maine, is being surrounded by walls of corrugated iron so that there may be no danger from the hot metal. The walls will make the building practically fire proof.

The Leavitt Machine Company, of Orange, Mass., have organized, with W. M. King, president; G. E. Bates, secretary and treasurer; directors, W. M. King, G. E. Bates. J. B. Farley, T. E. Leavitt; superintendent and general manager, T. E. Leavitt. They have leased Bingham's factory, on East River, and will commence operations November 1, manufacturing general machinery.

The Mount Washington Glass Company, at New Bedford, are experimenting in the use of a combination of steam and crude oil as fuel in their melting furnaces. It has not yet been perfected, but bids fair after some adjustment to be a grand success.

A new industry, to be known as the Nashua Lock and Hardware Company, has begun operations at Nashua, N. H. The organization has just been completed, and is capitalized at $20,000. Work will be begun in the vacant building of the Nashua Lock Company

Frederick Jeffts has purchased for about $90,000 a tract of land including over 55,000 feet on Union street, Worcester, adjacent to the Boston and Maine tracks. The purchase includes a three-story brick factory, with adjacent shops, formerly occupied by the Pond Machine Company, now at Plainfield, N. J. The plant will be used for manufacturing purposes, in which Mr. Jeffts is interested.

The Lyman Cotton Mills, Holyoke, Mass., are having constructed the largest iron penstock in that section of New England. It is 350 feet long, 11 feet in diameter, and the iron is ⅛ inch in thickness. When completed it will cost over $10,000.

The copper mines at Versline, Vt., in the eastern part of the State, have been pumped dry, and large gangs of miners are working in them night and day. To light the mines and the smelter, an electric light plant has been put in. The mines formerly employed 300 men.

The Lowell Machine Shop, Lowell, Mass., is fitting out a new cotton mill in Brazil, and it is also equipping a factory in Georgia for the manufacture of cotton bagging. The company are now running their works full time, with orders enough to keep them busy for a good while to come.

The Cleveland Machine Works, Worcester, have been awarded the contract to furnish the machinery for a new woolen mill on Prince Edward Island.

In the equity session of the Supreme Judicial Court, at Boston, on Friday, there was a hearing on a motion for a preliminary injunction to restrain the American Loan and Trust Company from selling under foreclosure proceedings on October 14 the property of the Boston Steam Heating Company. The plaintiffs are Irving A. Evans & Co., who have a claim of $25,000 against the company. During the hearing it was stated that the company would reorganize and resume business, and that the real cause of the suspension was that the return pipes were not of sufficient strength to withstand the pressure.

The Vulcan Iron Works, of New Britain, Conn., have been purchased by a large syndicate, which has absorbed several similar concerns, and of which Mr. Whittemore, of the Tuttle & Whittemore Company, of Naugatuck, Conn., is manager. They will shortly take possession of the works, and William Bacon, of Brooklyn, N. Y., will take up his residence here as local manager.

It is stated that the Dexter Machine Company, one of the most thriving industries of Dexter, Maine, has been sold to New York capitalists, and will soon be removed to Amsterdam, in that State.

The English electric welding syndicate has just placed an order with the Thomson Electric Welding Company, of Boston, for 16 welding plants for various classes of work from wire to 2-inch shafting. Each plant is to be complete in itself and ready to be placed with different manufacturers in England, who are waiting for them. It is the intention of the English company to establish works of their own near London, but until this can be done the American company will assist in every way possible. A contract for the mutual interests and protection of both companies has been executed, which will bring the companies into close relationship in the future. The English company are to be brought out probably in November.

It is a fact that the most economical method of supplying steam boilers with water is by the use of a pump driven by a belt. The Davis patent economic boiler and tank feed pump, for which Joseph Whitaker, 95 Oliver street, Boston, is agent, is designed especially to meet this want. It is a double pump, made in the best manner in all its parts, has interchangeable shafts and gears, and is complete in itself, ready to work by attaching the feed pipes to and from it and putting on a driving belt. The four valves, the only parts that can possibly get out of order, are so constructed that they can be got at by simply unscrewing a brass cap. The cut gears are noiseless in action, and, being double acting, makes it much easier on the driving belt and its action much smoother, and also makes it cost for the same capacity and workmanship much below any single acting pump. It is especially valuable in sandy and muddy water, as the plain valves can be ground in by any one in a few minutes, rendering them as perfect as when new.

The purchase of the Milwaukee and Northern Railroad by the Chicago, Milwaukee and St. Paul Railroad Company is an event of considerable importance to the Lake Superior iron ore districts. The Milwaukee and Northern is a short line connection between Milwaukee and Northern Michigan. It taps both the Menominee and Marquette ore ranges and connects with the other ore districts by means of the Duluth, South Shore and Atlantic. Terminating at Milwaukee, its southern connections depended on the arrangements that might be made with other lines running thence. Its acquisition by the St. Paul road makes that line at once an all-rail competitor for the transportation of iron ore to Chicago, as there will be no division of receipts with another line and no conflict of interests. The Lake Superior iron ore region is now better supplied with railroads than many of the older mineral sections of the country.

The Fox Solid Pressed Steel Company, whose works at Joliet, Ill., are the largest of their kind in this country, have passed into the entire control of Samson Fox, of England, under whose patents the company were operating. The works have hitherto been largely owned by the Illinois Steel Company. It is the intention of Mr. Fox to greatly enlarge the capacity of the plant and to extend its operations in new directions. Additional machinery has been ordered and is now on the way. The works have achieved a high reputation for the excellence of their product. They manufacture car-truck frames, locomotive boiler extensions, and a large line of railroad specialties. E. W. M. Hughes will continue in charge of the establishment, as heretofore.

VIRGINIA IRON NOTES.

Stanley is among the new industrial towns that is coming prominently to the front. The Development Company there have recently signed the contract for the removal to Stanley of one of the largest saw and file works in the country. It is also stated that a ferromanganese plant of 100 tons capacity will be established, and preparations for an iron furnace of 200 tons capacity are reported to be under way.

It is stated at Roanoke that the Duval Engine Works, of Zanesville, Ohio, has signed the contract to move its plant to Roanoke.

The Boiler and Engine Works Company, previously reported in this correspondence as having been incorporated at Buena Vista, is stated to have a capital stock of $300,000 Plans are now being prepared for the buildings of this company, and it will not be long before the contract for their erection will be given out.

The Rockbridge Company, whose president is Ex-Governor Fitzhugh Lee, and under whose auspices the industrial town of Glasgow has been built up, has increased its capital stock from $500,000 to $2,000,000, the additional $1,500,000 having recently been subscribed in cash by an English syndicate. The town will now develop with great rapidity and the air is full of reports of the organization of many various iron-working enterprises, the details of which will be furnished for publication at an early date.

Two thousand acres of valuable mineral lands, containing large deposits of iron ore and manganese, have been bought by the Little Valley Iron and Manganese Company, whose formation was recently reported in these columns. This company are now perfecting their plans for the extensive development of the property, and one or more iron furnaces are likely to be built.

During the last fortnight parties have purchased a $20,000 tract of valuable mineral land, in Smyth County, not far from the town of Marion; a company will be organized and the property developed.

The American Bridge Works, at Roanoke, are having plans prepared for an addition which they propose to erect to their works at an early date. The dimensions of this annex are 75 x 100 feet.

The Humbert Nut Lock Company, recently incorporated at Staunton, will increase their capital stock from $10,000 to $50,000. Work on their new plant is expected to begin shortly.

J. H. Gill, of Raleigh, N. C., is negotiating with the Rockbridge Company, looking to the establishment at Glasgow of machine shops and iron foundry.

A new iron mine, on Cripple Creek, near Speedwell, is being developed by a company, composed of J. W. Wilson, D. C. Buford, R. L. Ward and others.

At Luray, the Luray Mining and Mineral Company have been organized, with a minimum capital stock of $100,000.

A company with $160,000 capital stock are reported organized at Pulaski City for the purpose of manufacturing an automatic alarm danger signal for railroad crossings, the invention of J. W. Richardson, of Marion.

It is stated that the Iron and Nail Works Company, of Lynchburg, intend discontinuing the manufacture of nails, and will substitute a different plant for that department, increasing at the same time their other business.

A large force of hands are now busily at work night and day on the furnace at Buena Vista, and a correspondent from that place writes that it is expected to go into blast some time next month or early in November. The Loch Laird Mineral Company, of Buena Vista, have recently closed negotiations for the establishment on their property of a furnace of between 80 and 100 tons capacity.

The plans for the railroad machine shops to be erected at Lambert's Point by the Norfolk and Western Railroad Company have been completed, and work will probably begin on the buildings the first week in October.

A $750,000 development company has been organized at Gordensville to develop several thousand acres of mineral land and to establish iron and other industries. N. W. Rowe is president of the company, W. L. Fleming is vice president and C. B. Linney is secretary.

The Junction City Land and Improvement Company, with $2,500,000, have been incorporated by C. C. Lewis, Frank Woodman, J. S. McDonald and others, to develop ore properties and establish a furnace, rolling mill, stove works and other iron industries. This company own 1300 acres of land near New Castle.

Work on the great Baltimore Belt Line Road, much of which will be underground, has begun. The Philadelphia project hangs fire.

American Meeting
OF THE
IRON AND STEEL INSTITUTE.

The first session of the first meeting of the Iron and Steel Institute of Great Britain began at Chickering Hall, New York, on the morning of October 1, the president, Sir James Kitson, being in the chair. As guests were many of the most prominent members of the several American Engineering societies and of the Verein Deutscher Eisenheuttenleute. The matter presented at this the first meeting ever held by the Institute in this country was a surprise, and outlined in part what could be expected from the extended tour of the country thus initiated. The first paper read attracted great attention, because of its direct bearing upon a subject in which all were interested and because of its direct variance, both in the methods pursued and the results attained, with the practice common in Europe. It is, therefore, fair to assume that the trip now begun will result in further surprises, and will show, especially in the handling of iron from the ore to the completed product, some direct copies of foreign practice, some modifications, and some innovations. But as was expressed later in the day, the long journey of 10,000 miles will not have been without good results, even if nothing further be gained than the information presented at this meeting.

The first speaker was Mr. Carnegie, who welcomed in most hearty language the distinguished visitors from the other side. [The most essential portions of this address we presented in our issue of last week.] In reply, Sir James Kitson said, in part:

Gentlemen of the Iron and Steel trade and of the Engineering Profession of the United States: It is very pleasant and agreeable to hear that word "welcome" spoken in the mother tongue. It has been my duty to answer messages of welcome in other lands. I remember to have descended at the station at Buda Pesth and to have been addressed in eloquent language, which I was not able to understand. It was Hungarian. It was my lot also to respond last year, as president, to the words of welcome which were offered to us by our French hosts. It is doubly pleasant and agreeable to respond here in the United States to that word "welcome," spoken in the mother tongue, and offered to us in such eloquent terms by your representative, Mr. Carnegie. Mr. Carnegie has pointed out to you that the circumstances under which we meet here are very remarkable. The invitation which we have acknowledged by our presence in New York has long been offered to us and has long been discussed. I believe as far back as 1873, when we met at Liege, under the presidency of Sir Lowthian Bell, your Secretary, Dr. Raymond, who still, I am glad to see, continues his arduous and scientific labors offered us then an invitation on behalf of the Mining Institute. Well, gentlemen, the perils of the voyage and the difficulties of transport made us somewhat timid in accepting your invitation, because we were afraid it might not be possible, owing to those difficulties, to give you here a full and true representation of the great industries which we represent. For example, we fondly hoped that our friend Sir Henry Bessemer would have been able to be with us, but of course the difficulties of the sea passage and his age have prevented him from being here; but he desired me to say to you that it was with the greatest reluctance that he has given up all hope of being able to undertake the voyage.

Well, gentlemen, Mr. Carnegie, in his terse manner of speaking, has said that this is

A Day of Firsts.

Well, gentlemen, we are met in the year when the United States has become the first producer in iron in the world. For the first time the production of pig iron in the United States has exceeded in the year past the production of Great Britain, and I fear from what we see and what we are to see, that you have attained in that respect a pre-eminence which we shall never be able to regain. However, as Mr. Carnegie said, two of a trade can agree; and I always consider that when my neighbor is prosperous, when my competitor is full of work, the conditions of commerce must be favorable to me, and if the United States is producing and consuming this enormous quantity of material, rest assured that its superabundant prosperity cannot fail to react upon other nations and other competitors.

Gentlemen, this is a day of firsts, because we have had an address of welcome offered to us by the first iron producer of the world. I believe I am well informed in stating that Mr. Carnegie is the largest producer of iron and steel in the world.

This is a day of firsts, because on all hands we hear of the stupendous preparations which are being made for our reception, and we know that the eloquent words which Mr. Carnegie has spoken do not in any way foreshadow the wondrous welcome which we are to receive throughout the United States.

It is very pleasant, and it gave food for reflection to hear our host lay so much stress upon the hereditary principle. Mr. Carnegie very rightfully laid great stress on the hereditary principle in the iron trade; and we may take to ourselves the credit of representing, if not in our own persons, yet in a glorious past, the iron trade of the world. I think I may fairly claim for us that the British iron trade has been everywhere the pioneer of invention and of improvement in the iron and in the steel trade, and therefore, although we may not here together be a full representation of the great interests which we represent, yet, looking to the past we accept thankfully the gracious welcome which you, sir, have offered to us.

Sir James Kitson, in his more formal address, said that the predictions and conclusion of Mr. Cobden, who in 1835 said that "if knowledge be power, and if education gives knowledge, then must the Americans inevitably become the most powerful people in the world," have been realized and surpassed.

We meet here on the invitation of the members of the American Institute of Mining Engineers, with whom are also associated the societies of mechanical and civil engineers, representing fully the metallurgical interests of the United States. This invitation was repeated to us in eloquent terms by the Hon. Abram S. Hewitt, at our meeting in London in May of this year, and further supplemented personally by Major Burke, who conveyed to the Institute an invitation to visit the principal ore and coal sections of Alabama. We come to examine the industrial condition and to inspect as fully as our time will permit, the natural advantages and the manufacturing capabilities of the iron and steel trade of the United States. We come here simply as the guests of the iron and steel trades of the United States, but the welcome we have received, and the remarkable reception which has been accorded to us since we landed on these shores, gives us ground for believing that we are also welcomed by great numbers of the people of the United States.

Following the establishment of many scientific institutions, which are among the distinguishing characteristics of the times in which we live, we have had a great creation of scientific societies devoted to special subjects. Among them the Iron and Steel Institute, whose Autumn session I am now privileged to open in New York, which was founded in the year 1869. Through its agency many inventions, new machinery, new method, and processes, which would otherwise have been but tentatively and tardily adopteds have been appreciated and acquired promptly, and made rapidly and advantageously the property of the whole world; and what has been, too, of almost equal practical service, errors, mistakes, and misleading methods have been discussed, exploded and discarded.

The Iron and Steel Institute.

Our first president was His Grace, the Duke of Devonshire, whose acceptance of this position conferred a prestige on the Institute, and on the iron and steel trades, by securing the recognition of a true representative of social rank, vast metallurgical interests and high intellectual attainments. This recognition of the great importance of the aims of our Institute, and the unbounded possibility of the value of its inquiries, discussions and communications, which were to be undertaken for the advancement of the iron and steel trades, was at this moment most valuable. He was succeeded by Sir Henry Bessemer, whose brilliant discovery of a process for the production of steel, with which his name will forever be associated, has revolutionized the trade and led to vast industrial developments throughout the world. Next came Sir Lowthian Bell, described, and justly so, by your Professor Howe, as "*Magister magnus in ignibus*," whose interest in our work and proceedings has been maintained with unflagging zeal for one-and-twenty years, whose scholarly attainments and scientific and practical knowledge have been of infinite service to this Institute.

These three first presidents happily still remain to us. Sir William Siemens has passed away, but his contribution to the Institute, his scientific attainments, his discoveries and developments of the regenerative furnace, the process of open hearth steel making, and the production of a description of mild steel, so generally applied in commerce, are among the inestimable advantages conferred on the world by the labors and discoveries of our great metallurgists.

The knowledge and the experience of our engineers, our chemists, our scientific and practical iron and steel workers, has been freely and ungrudgingly communicated to the world in our Transactions. The rapid progress in the development of the Bessemer process has been materially contributed to by the expositions of Sir Henry Bessemer and his co-workers, made at the meetings of this Institute, and published through its medium.

It is very interesting, too, to note the rapid progress of the Basic process, invented and developed by Messrs. Thomas and Gilchrist, materially assisted by other members of this Institute.

Our works are well known to members of the trade in the United States, and I think we have collectively done something, as British Iron and Steel manufacturers, to

justify to some extent the opportunities you are now so generously opening up to us. The rulers of my native land have not all been wise, or generous, or unselfish. Their treatment of the American Iron Trade in the last century was stupid, illiberal and grasping. I read in the history of the United States of America that in 1750 the manufacture of Iron in New England, which had already been started with some prospect of success, was forbidden by an Act of the English Parliament under very severe penalties.

Consumption of Iron.

We have grown wiser since that time; we can see that in this wide world there is room for the iron and steel manufacturers of England, the United States and Germany. The world must have iron and steel. That nation is the wisest and most civilized which consumes the most of them. The United States and England are not likely, at all events, to dispute this assertion. The average consumption of iron (pig iron) per inhabitant in the United States, taking the population at 60,000, was in 1889 about 310 pounds per head; in the United Kingdom of Great Britian and Ireland the average consumption was about 300 pounds per head; but of this a large quantity was exported in the form of machinery. In the United States it goes almost entirely into consumption. The consumption is steadily increasing, having risen between 1881 and 1889 in the United States from 270 pounds to 310 pounds; in the United Kingdom from 287 pounds to 300 pounds.

Although vast multitudes of the human race will long rest outside the sphere of the producers of iron and steel, there are regions now rapidly awaking to a knowledge of the resources which the engineer has it in his power to develop within them. In South America, in Australia, China, India and South Africa we can see possibilities of demand which lend themselves to a consumption of iron and steel which shall task the resources of our great industries in either Continent. While in the United States continues to find its market in ever-growing demands from a civilized and prosperous people at home, we in England shall have in more distant field, easily accessible to us from our insular position, a great market for our produce. We can look forward, each in our own sphere, to a growing commerce to cope with which our united skill, aided by invention shared, and knowledge freely communicated, shall confer lasting benefits on the world

Announcements.

James F. Lewis, Chairman of the Local Committee, then briefly outlined the programme which had been prepared for the entertainment of the visitors, after which Wm. P. Shinn, President of the American Society of Civil Engineers, gave the details of the arrangements made by the Committee on Transportation. Cordial messages of invitation were received to visit Canada. Archibald Blue, Deputy Minister of Agriculture for Ontario, presented the earnest request of the Government of Ontario and of the Board of Trade of the City of Toronto, that the Institue would visit in a body the country of the Great Lakes. Dr. Zelwyn, Director of the Dominion Geological Survey, followed Mr. Blue and spoke for the entire Dominion Government in offering the freedom of the whole colony to the Institute.

At this stage of the proceedings the president said that it had been the intention to present to the Hon. Abram S. Hewitt the Bessemer gold medal, which had been awarded to him by the Council at their meeting in London. Sir Lowthian Bell explained the absence of Mr. Hewitt, whose guest he was, by stating that it was physically impossible for him to be present. The speech prepared by Mr. Hewitt, and which we published in *The Iron Age* of last week, was then distributed in pamphlet form.

Sir Frederick Abel was then elected president of the Institute.

The first paper read was by James Gayley, Braddock, Pa., on

The Development of American Blast Furnaces with Special Reference to Large Yields.*

The development of blast furnace practice in America in the direction of large yields is mainly the history of our working since the year 1880, as the advancement that has been made in the last decade is greater than that in the third of a century previous. A new era in the manufacture of pig iron began in 1880 with the putting in blast of the Edgar Thomson furnaces. These furnaces at once leaped to the front as pig iron producers, and have maintained that position —with but one brief interruption—ever since. I shall, therefore, confine myself mainly to a description of these works, showing the changes in design and practice by which these results have been achieved. In order to show more clearly the progress that has been made since 1880, I shall refer briefly to the best work that was done in the ten years previous to that time. The Struthers furnace, in Ohio, was one of the first to attract attention in the matter of large outputs. This furnace was 55 feet high, 16 feet diameter of bosh, 9 feet hearth, stock line about 8 feet 6 inches. The fuel was raw coal. This furnace in December 1871, made 1602 tons of iron, and in January 1872 made 1642 tons. The best output in a single week was 400 tons. By March 1876 the product had increased to 2032 tons. The furnace was blown by one engine with an air cylinder 72 inches in diameter and 4 feet stroke. The only change made from 1871 to 1876 was the addition of a second blowing engine. The size of the hearth was much in advance of the construction usual at that time, and was in fact as large as would now be put in a furnace of the same size. The good results obtained at this furnace were largely due to the fact that the manager, Mr. Thomas W. Kennedy, broke away from the traditional practice of regulating the quantity of blast by the pressure gauge, and substituted instead the revolutions of the engine—a practice that obtains today.

A record of No. 1 furnace of the Isabella furnaces, located at Pittsburgh, has been furnished me; and, as these furnaces have since become famous in the annals of pig iron manufacture, a return of their work at that time will be found interesting. I have not been able to secure the lines or detail construction of this furnace, but the general dimensions were: Hight, 75 feet; diameter of bosh, 20 feet; cubical capacity about 15,000 feet. The furnace was "blown in" in January, 1876, and continued in blast until May, 1880—making a total output of 117,575 tons of pig iron, or an average of 2264 tons per month. The consumption of coke per ton of iron averaged 3000 pounds; the temperature of blast ranged from 1000 to 1100 degrees, with a blast pressure of 4 to 6 pounds. No record was kept of the amount of air blown. Also located in Pittsburgh are the Lucy furnaces, owned by the firm of Carnegie, Phipps, & Co. These furnaces ranked with the Isabella as the largest producers in America. I have been so fortunate as to obtain the lines of one of these furnaces, the Lucy No. 2, built in 1877, which I show in Fig. 1. The generel dimensions are as follows; Total hight, 75 feet; diameter of bosh, 20 feet; diameter of hearth, 9 feet; cubical capacity, 15,400 feet. This drawing shows a bell 12 feet in diameter, but Mr. H. M. Curry, who was then manager of the works, advises me that the bell generally in use was 11 feet in diameter. During a part of the blast a bell 12 feet in diameter was tried, but not proving to be of advantage was abandoned. In the construction of this furnace, the noticeable features are a narrower hearth and a wider top than are now put in furnaces of the same cubical capacity; but at that time it was considered an excellent shape, and certainly did produce some excellent results. As early as 1878 this furnace had made a monthly output of 3286 tons, on a coke consumption of 2793 pounds per ton of iron, and in one week shortly afterwards made 821 tons. The furnace was "blown in" in September 1877, but after running a few months was

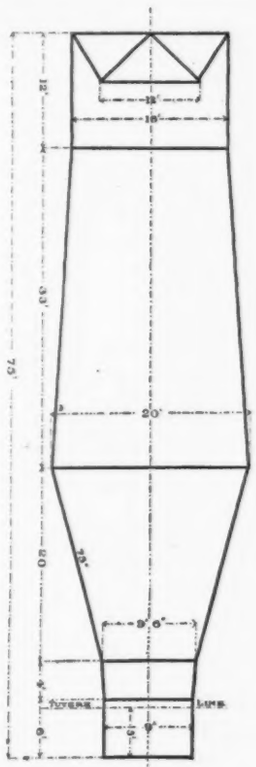


FIG. 1.

blown out in order to repair the bosh walls which for some reason had rapidly given way. In the following March the furnace was again started, and continued in blast for nearly 34 months, making in this time an output of 92.128 tons, or an average of 2737 tons per month, on an average coke consumption of 2865 pounds per ton of iron. For the first 12 full months the output was 33,552 tons, on a coke consumption of 2850 pounds. The amount of air blown was 16,000 cubic feet per minute, which entered the furnace through six 8-inch tuyeres; the temperature of blast was 915°, and the pressure at tuyeres 5 pounds. The ore mixture yielded in the furnace 60 per cent. iron. The work that was done at this furnace was unquestionably the best, all things considered, that had been accomplished prior to the starting of the Edgar Thomson furnaces.

Furnace "A" of the Edgar Thomson works was originally a charcoal furnace at Escanaba, Mich., but was removed and erected on its new foundations in 1879. The dimensions of this furnace, as will be seen by a reference to Fig. 2, are as follows: Hight, 65 feet; diameter of bosh, 13 feet; diameter of hearth, 8 feet 6 inches; cubical capacity, 6396 feet. Six tuyeres, 4 inches in diameter, were

* All tons are gross tons of 2240 pounds, and all temperatures are Fahrenheit.

used; these, projecting 7 inches inside the crucible made the efficient diameter of hearth 7 feet 4 inches. The tuyeres were placed 5 feet 6 inches above the hearth line. In Volume VIII of the "Transactions of the American Institute of Mining Engineers," a description is given of the "blowing in" and subsequent working of this furnace, by Mr. Julian Kennedy, who was then manager of the furnaces. The following points of construction are emphasized in his paper. The interior lines make very small

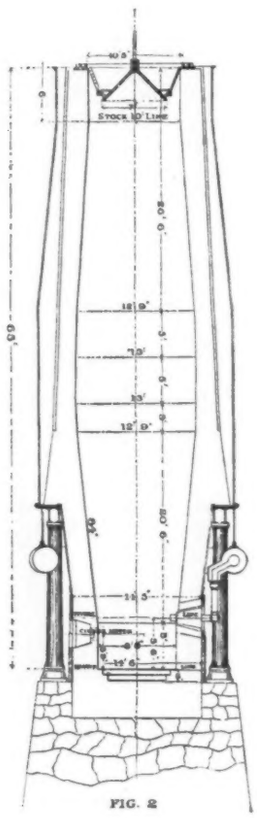


FIG. 2

angles with each other—so small, in fact, that the arc of a circle drawn from the top to the tuyeres will not deviate more than two inches from the line as given. Particular attention was given to rounding the angles. The bosh is located about midway in the furnace, making the bosh wall very steep. The batter of this wall was $1\frac{4}{5}$ inch to the foot, which is equivalent to an angle of 84 degrees. The furnace was lined throughout with small bricks. The stove equipment consisted of three Siemens-Cowper-Cochrane stoves, 15 feet in diameter by 50 feet in hight. This furnace was "blown in" in January, 1880. The ore mixture consisted of Tafna, McComber, Pilot Knob, and Somorrostro ores, yielding in the furnace 54.5 per cent. iron. The output of the first full week was 442 tons, and reached 537 tons for the fourth week. The output and consumption of coke for the first few months are as follows:

Month.	Tons.	Pounds coke per ton of iron.
January	1,634	2,675
February	2,236	2,306
March	2,762	2,306
April	1,586	*2,482
May	2,226	1,945

*Furnace was stopped for four days.

In June the furnace was changed to making spiegel, and has been used almost exclusively ever since for making the various grades of spiegel and ferromanganese. The average weekly output for the month of March was $644\frac{1}{2}$ tons, one day having been lost.

The best week's output was 671 tons. The blast was heated to an average temperature of 1050°, the utmost that the stoves would furnish; the pressure at the tuyeres was $6\frac{1}{4}$ pounds. The engine equipment consisted of two vertical blowing engines, one of which was new, with a blowing tub 84 inches in diameter and 4 feet stroke; the other, a small and inefficient one, had been brought from Escanaba. But it so happened that furnace "B" was in course of construction, and one of the engines belonging to this furnace was in good running order; consequently, the Escanaba engine was retired from active service, and these two larger engines were used to supply furnace "A."

The volume of air forced into this furnace was 15,000 cubic feet per minute, or as much as was used elsewhere for furnaces of more than twice the capacity. The results obtained were surprising, and it is no wonder that the pig iron making world regarded them with an astonishment amounting, in many cases, to incredulity. Considering the cubical capacity of the furnace, the rate of driving was certainly excessive; and, that the results on fuel were so low, as compared with the subsequent consumption on larger furnaces where the same practice was employed, is mainly due to the narrow furnace stack. These fuel results, as I shall presently show, were much lower than any obtained from the larger furnaces in the next five years; and, had a distinction been then made between rapid driving on the one hand and excessive driving on the other, many American furnaces would have reduced their outlay for fuel enormously.

In Fig. 3 is shown a drawing of the second furnace erected at these works, of which the general dimensions are as follows: Hight, 80 feet; diameter of bosh, 20 feet; diameter, of hearth, 11 feet; cubical capacity, 17,868 feet. The brickwork of the stack was held together by 8 inch iron bands supported by staves of T-iron, forming a crinoline. The bosh walls were banded in the same manner. The walls of the hearth were surrounded by solid cast iron plates, securely bolted, no cooling plates of any kind being used. The

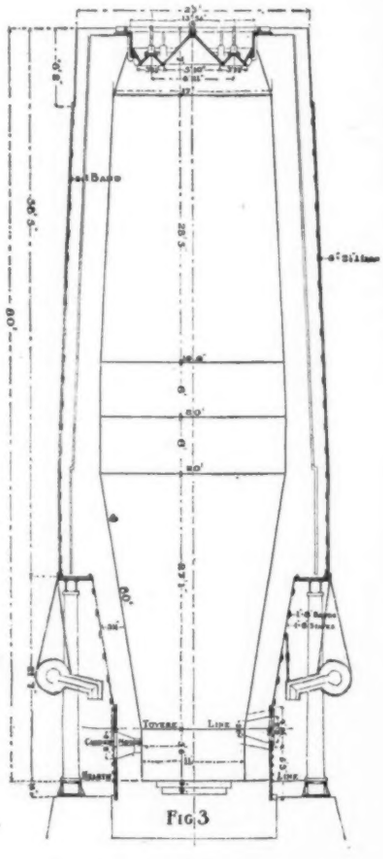


FIG 3

stock was distributed at the top by a double bell, in which the central cone remained stationary; while the outer conical ring, being lowered, cast the stock towards the wall and center of the furnace. One feature of this construction, differing from that of other furnaces then using coke for fuel, was the large hearth, providing more space for combustion. As originally planned, the hearth was 9 feet in diameter at the bottom, and sloping up to the tuyeres; but, before building, Mr. Kennedy changed the plan, so that the inwalls of the hearth would be straight, making the diameter 11 feet. There was, moreover, an increased number of tuyeres, eight being used, and an increased elevation of tuyeres above the hearth level, all of which were necessary for rapid driving and large yields. In the anthracite district large hearths had been tried at a much earlier day. As early as 1854 the Thomases, at the Crane Iron Works, in the Lehigh Valley, had tried enlarging their hearths by pulling back the tuyeres until a diameter of 11 feet was reached. From this experiment they obtained such excellent results, both as to output and quality of metal, that they afterwards adopted as a standard that the diameter of the hearth should be one-half the diameter of the bosh. But while the hearths of various furnaces had been enlarged after they were in blast, yet no American furnace up to that time had been constructed with so large a hearth as this one at the Edgar Thomson works. In another respect this furnace was well prepared by its designers for a high productive capacity, viz., in its equipment. Fire brick stoves of the most approved type were erected. Substantially built blowing engines were provided, and they were rendered efficient by an ample supply of boilers—a point in which other furnaces were then sadly lacking. At the same time all the flues and mains were constructed sufficiently large, and in the most substantial way. In fact, no furnace previously erected had been planned on such a liberal basis; consequently, large yields were to be expected.

The furnace was put in blast in April 1880. In the following month an output of 3718 tons was made, and the next month showed 4318 tons; thus fully justifying the claims of its designers by eclipsing all previous records. The detailed record of the work done by this furnace during the earlier months of the blast is as follows:

Months.	Tons.	Pounds coke per ton iron.
April	2,723	2,535
May	3,718	2,574
June	4,318	2,344
July	4,345	2,706
August	4,601	2,811
September	4,221	2,757
October	4,722	2,736

It will be noticed that the consumption of fuel increases as the summer months advance. These works, being located on flat land along the Monongahela river, are more particularly affected than elsewhere by the content of moisture in the atmosphere, it being nearly twice as much in summer as in winter. While this fact has always had an important bearing on our fuel economy, yet, in this case, another feature of the practice tending to increase the fuel consumption was the increased rate of driving; the volume of air blown having been gradually increased to 30,000 cubic feet per minute, engine measurement, taxing alike the efficiency of the engines and the stoves. However, a high productive capacity was aimed at, and an output of 4722 tons in a month was certainly marvelous at that time, and was either regarded as incredible or accounted for on the supposition that the furnace had been transformed into a cupola.

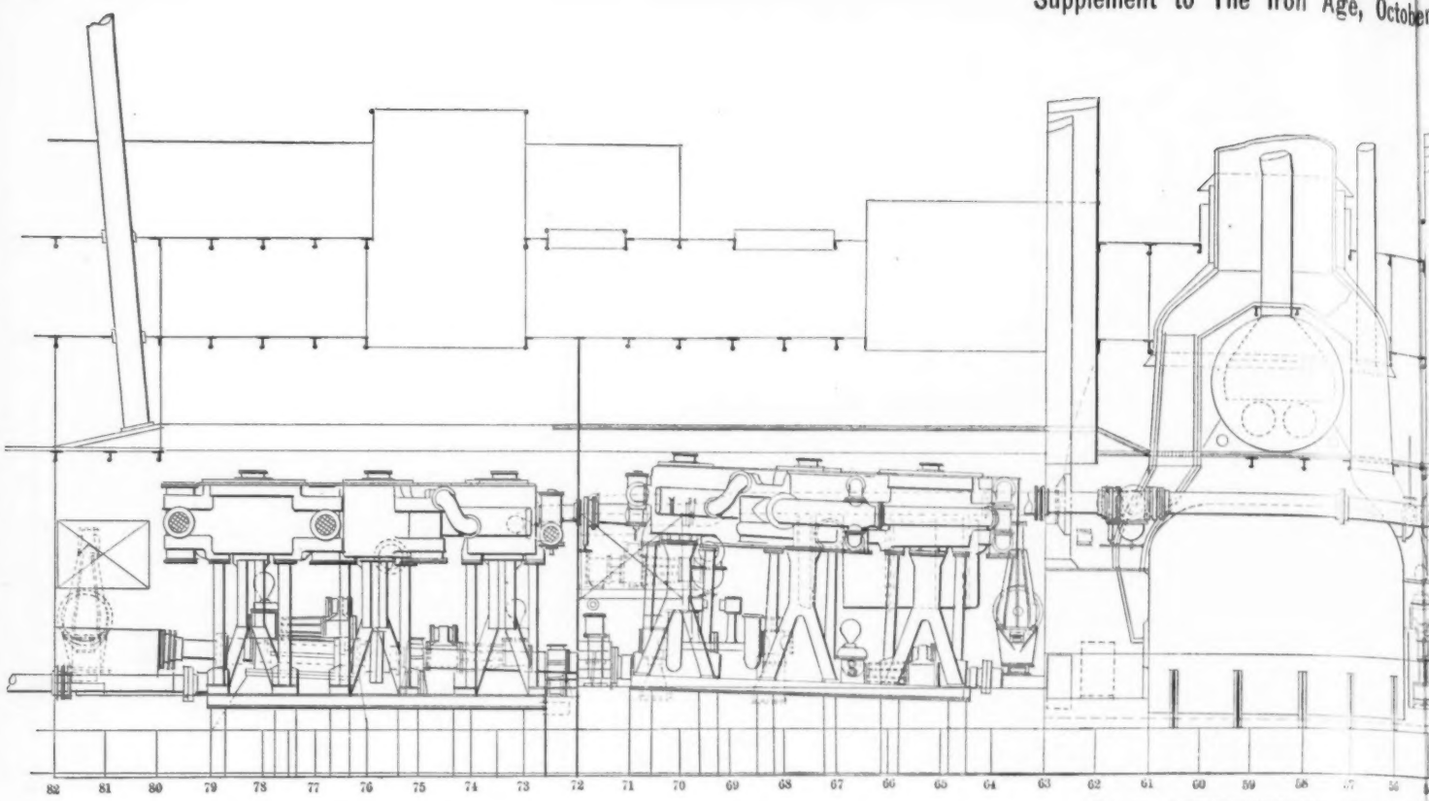


FIG. 2.—LONGITUDINAL SECTION

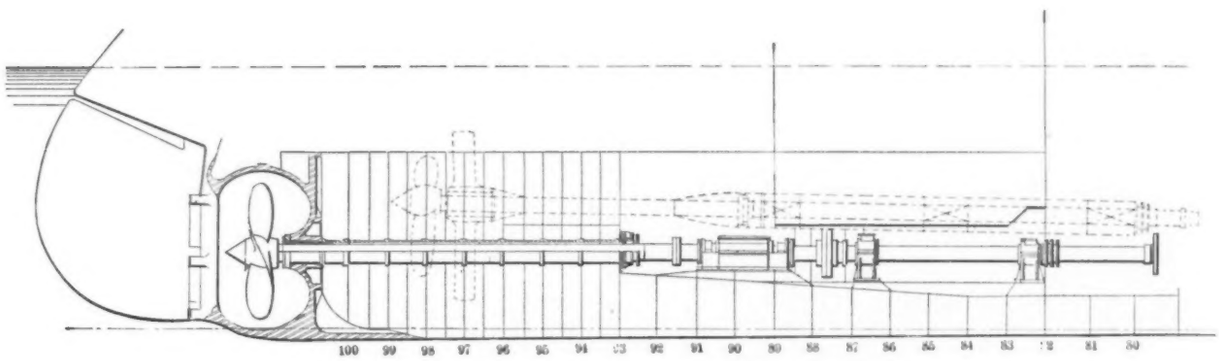


FIG. 11.—LONGITUDINAL CENTRAL SECTION OF STERN.

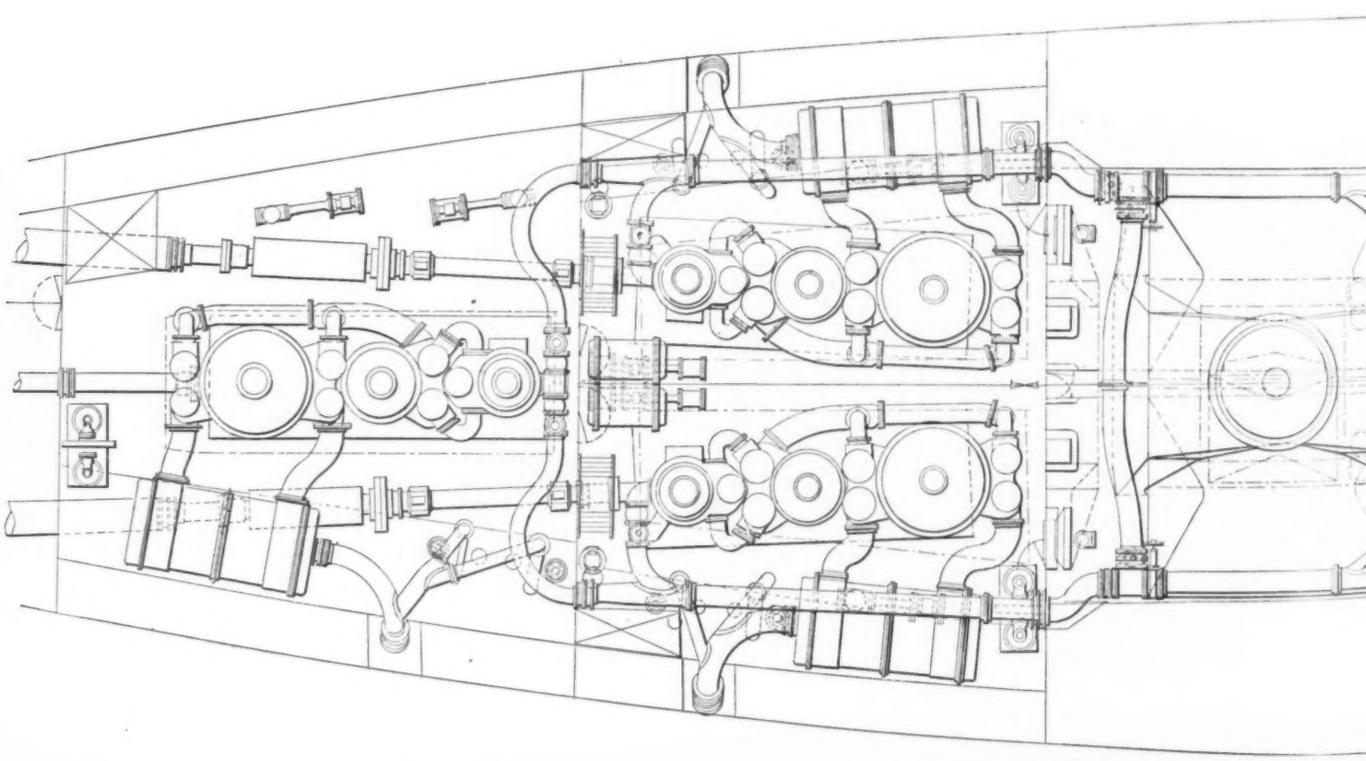
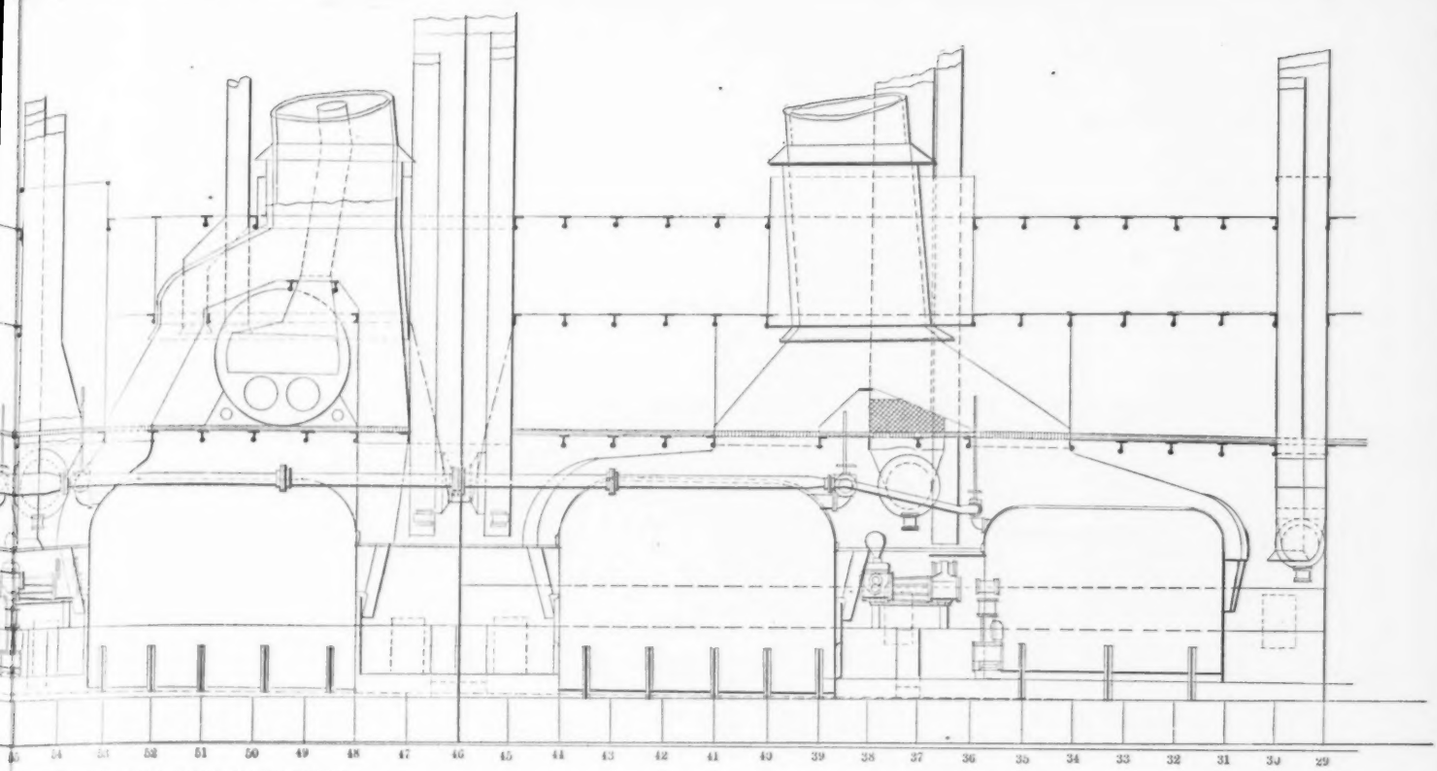


FIG. 3.—PLAN OF ENG

TRIPLE SCREW STEEL PROTEC



OF ENGINE AND BOILER SPACES.

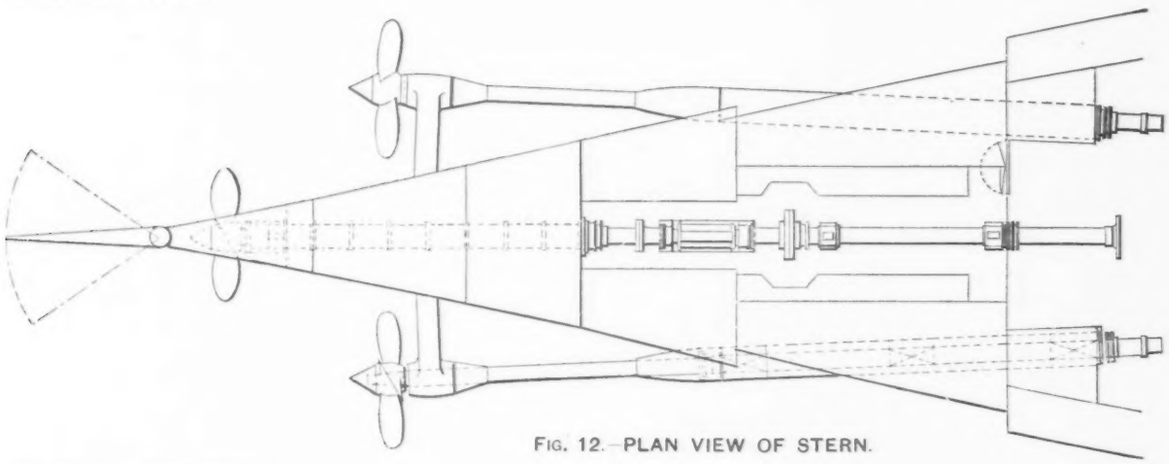
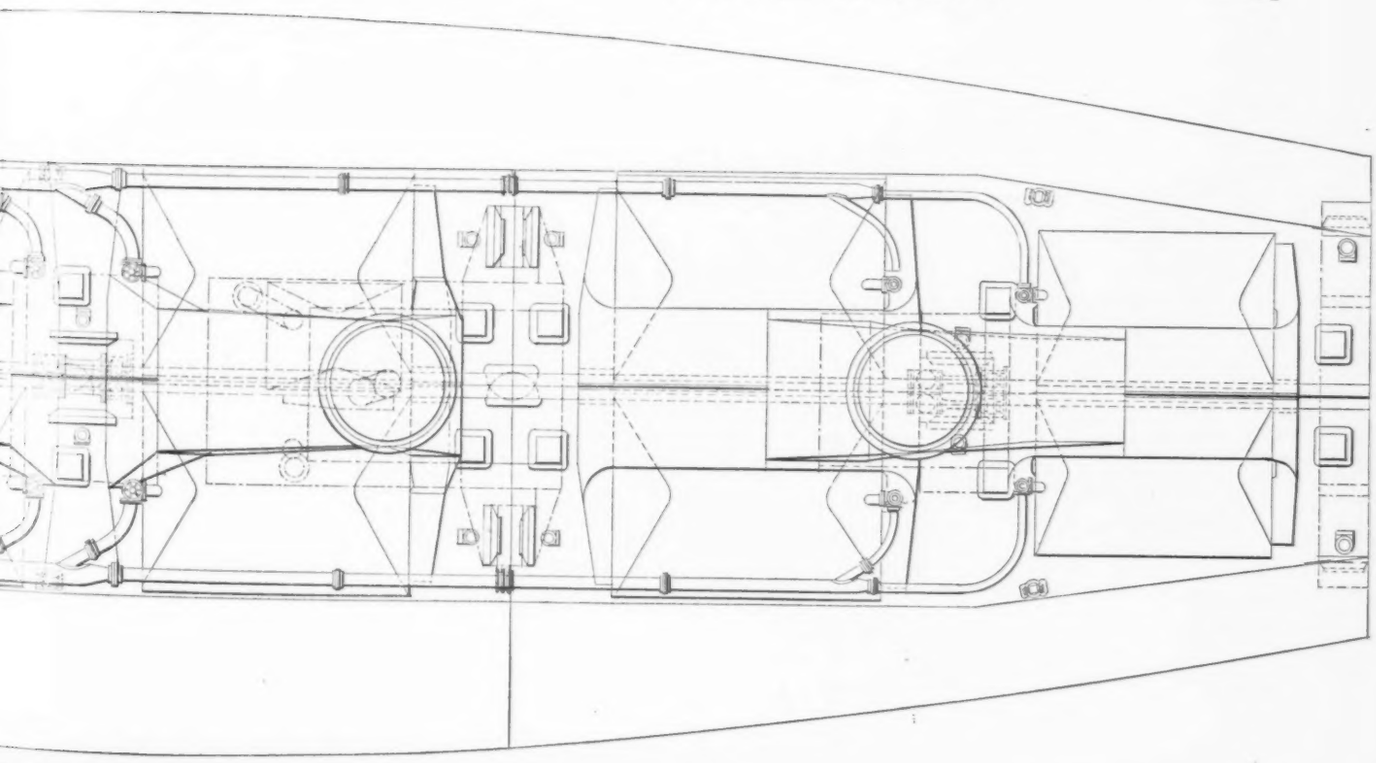


FIG. 12.—PLAN VIEW OF STERN.



E AND BOILER SPACES.

TED CRUISER No. 12, U. S. NAVY.

by melting large quantities of scrap. But the furnace records show that the yield of ore mixture was 55 per cent. iron. The weight of limestone was 25 per cent. of the weight of the ore. An analysis of the cinder shows:

	Per cent.
Silica	32.31
Alumina	13.20

The limestone contained a very small quantity of magnesia. The blast entered the furnace through eight bronze tuyeres of 5½ inches diameter, and was heated to a temperature of 1100°. The silicon in the iron averaged about 2 per cent. The rapid wear of the furnace walls, through the use of such a large volume of air, gradually increased the consumption of coke to over 3000 pounds per ton of iron. At the end of the first 12 full months the output was 48,179 tons, on an average coke consumption of 2859 pounds per ton of iron. The second year showed an average consumption of 3200 pounds of coke, with a decrease in yield. The upper brickwork of the stack having given way, the furnace was blown out after a blast of two years and five months, having made a total product of 112,060 tons, on an average coke consumption of 3149 pounds per ton of iron.

The results obtained in this blast determined several important changes in construction. It was seen that the crinoline structure afforded inadequate protection to the brickwork of the stack, in consequence of which it was torn down and replaced by an iron jacket; also, that the bosh walls should be protected so as to preserve as far as possible the original lines, and the hearth be surrounded with water cooled plates. The double bell was also found to possess no special advantage, and was abandoned. These changes were introduced in the furnace next erected at these works. But, before leaving this furnace, I wish to emphasize the bearing that the practice of rapid driving, begun on furnace "A," and further developed on this this one, had on the general practice of this country. The large outputs obtained from this furnace by the use of a large volume of air, was a matter of common knowledge; the practice of fast driving soon became the accepted one, and with our national ardor it was prosecuted enthusiastically. In every direction engines that had been running along for years at a methodical gait were oiled up and started off at a livelier pace; new boilers were added; the old iron hot blast stoves, not supplying sufficient heat, were torn down and replaced by the more efficient fire brick stoves. At many works rapid driving degenerated into excessive driving. True, the outputs increased; so also did the consumption of fuel, and that at a surprising rate, until it was thought well nigh impossible to produce a ton with 2600 pounds of coke.

Mr. E. C. Potter, of Chicago, sounded the note of warning in 1885, and great credit is due to him for demonstrating that large outputs and low fuel consumption are compatible. Since then a marked change in our practice has taken place, and the volume of air blown has been greatly diminished.

Although the practice of rapid driving has been much decried, yet in many ways it has resulted beneficially. It has brought in an equipment of hot blast stoves, boilers, engines, &c., sufficient to accomplish a large amount of work without a constant strain on every part—a condition very rare prior to 1880, and it has also developed a construction of the furnace stack, by which larger outputs from a single lining can be obtained with less irregularity in the working.

In Fig. 4 is shown a furnace of different construction from either of the preceding, it being my purpose to present successive types of construction rather than changes in the same furnace. We find this furnace constructed with special regard to the better protection of brickwork of hearth and bosh. The general dimensions are as follows: Hight, 80 feet; diameter of bosh, 23 feet; diameter of hearth, 11 feet 6 inches; stock line, 17 feet; bell, 11 feet; cubical capacity, 21,478 feet. The bosh is placed at about the center of the stack, making very steep walls. The hearth is also made wider by 6 inches than in the furnace previously described. The hearth

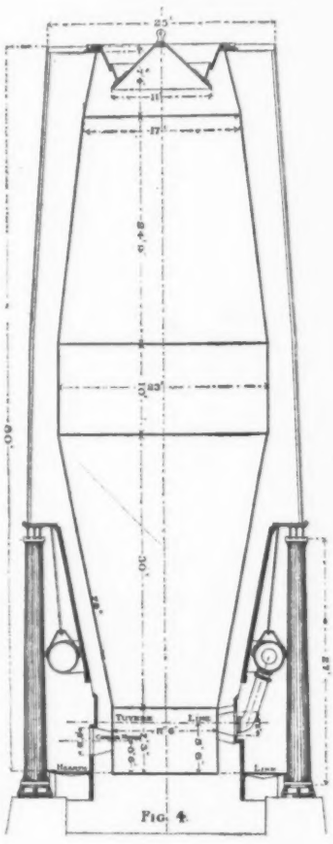


FIG. 4.

walls are surrounded by cast iron plates with a coil inside for the circulation of water. Around the bottom of these plates is a gutter, through which waste water from the cooling plates flowed, affording better protection to the bottom of the hearth. Above this row of plates, at the tuyere breasts, is another circle of cooling plates, partially inserted in the brickwork. The walls of the bosh are encased in a jacket of wrought iron, ½ inch in thickness. This jacket is bolted on to the mantle. The bosh walls inside the jacket were made but 22½ inches thick, so that the cooling effect of the air currents on the jacket would prevent any very rapid wear of the brickwork.

It is a fact well known in our practice that the best records are obtained within the first year of the blast, as the walls are not then affected to any great extent by wear. With the better protection afforded by more recent construction this difference has not been so marked. This furnace was put in blast in 1882, and in the second month made the large yield of 6045 tons, on a coke consumption of 2617 pounds. In the first 12 full months the output was 65,947 tons, on an average of 2570 pounds of coke per ton of iron, thus exceeding, by over 11,000 tons, the best output that had previously been obtained in the same time from any furnace at these works, and with a much smaller consumption of fuel. The record for the best month during this period was 6131 tons, on a coke consumption of 2387 pounds per ton of iron. The amount of air blown was 27,000 cubic feet per minute, which was heated to an average temperature of 1000°. The pressure of blast at the tuyeres varied between 9 and 10 pounds. After a blast of 17 months' duration this furnace was blown out, having made a total output of 90,317 tons, on an average coke consumption of 2613 pounds per ton of iron.

For what reason this furnace was blown out I do not know since the consumption of fuel, even in the last two months of the run, did not increase more than 100 pounds above the average. The furnace records afford no explanation of the cause. As a matter of fact, the results were much better than any obtained for a number of years afterwards. They serve, also, to show how very materially a slight protection afforded to the furnace walls affects the output and the consumption of fuel.

As illustrating the effects of an excessive volume of air, I will mention a furnace put in blast two years later—of practically the same dimensions and protected to the same extent, but blown with 33,000 cubic feet of air per minute—which made an average output of 5000 tons per month, on a coke consumption of 3000 pounds per ton of iron. This is the largest amount of air that I know to have been forced into any furnace. The fuel consumption is what might have been expected, as the furnace was driven at such a rapid rate that the imperfect reduction of the ores in its cooler parts necessitated the completion at a temperature sufficiently high for the CO_2 to react on the carbon.

In the next drawing, Fig. 5, is shown a different arrangement for maintaining the bosh walls. The lower part of the hearth

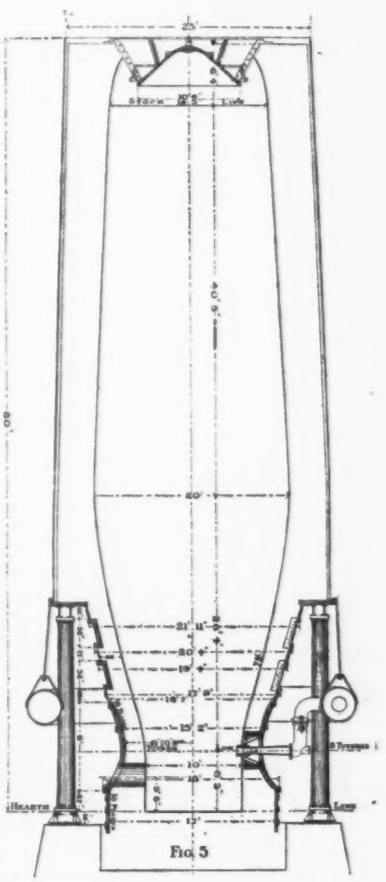


FIG. 5.

is surrounded by cast iron plates. On the top of these rests a water cooled corset jacket, fastened together with links, and banded at the upper and lower ends by iron bands 6 inches wide and 1 inch thick. The wrought iron bosh jacket is dispensed with, and in its stead are two bands of water cooled plates, covering the greater portion of the brickwork. These are held

in place by bands at the top and bottom, and also by being inserted a short distance in the brickwork. The tuyere fittings are unique. The arrangement, as shown in the drawing, consists, first, of a large oval block, made of cast iron and water cooled. Fitting into this, with sufficient space left for a clay packing, is a large bronze cooler, oval shaped at the outer end, but with a circular opening at the inner end for the insertion of the tuyeres. This cooler was supported by trunnions resting on the block, by means of which the nose could be either elevated or depressed. The tuyeres were shaped to make a ball joint connection with the cooler, so that a horizontal delivery of the blast could be obtained with any inclination of the cooler. The adjustment was such that the tuyeres were placed in a staggered position, there being as much as 6 inches between the center lines of each adjacent tuyere. The reason given for this placing of tuyeres was "to obtain a greater area of contact between the fuel and the air." No such benefit, however, was derived, and the tuyeres were subsequently placed on the same level.

The dimensions of the furnace are shown in the drawing. The cubical capacity was 16,680 feet. In February, 1885, the furnace was "blown in." The volume of blast was rapidly increased until, in the following month, it reached 31,000 cubic feet per minute. The blast entered the furnace through eight tuyeres, 7 inches in diameter, and was heated to an average temperature of 1200°. The pressure at the tuyeres was 8½ pounds. The average monthly output from March to August, inclusive, was 5122 tons, on a coke consumption of 2874 pounds per ton of iron.

As this was the third blast for the same furnace (a companion furnace to that shown in Fig. 3), a comparison with the record made at the same relative time on the first blast will show the effect of different rates of driving on the fuel economy. In the first blast the coke consumption was 2600 pounds, with a volume of air of 24,000 cubic feet per minute; in this blast it has risen to 2850 pounds, through an increase in the volume of air of 7000 cubic feet.

On taking charge of these works in October, 1885, I endeavored to reduce the volume of blast in order to diminish the consumption of fuel. The reductions were made slowly, until the volume was 28,000 cubic feet per minute. Many attempts were made to reduce it still further, but as each attempt was invariably met by great irregularity in the working of the furnace, further efforts in that direction were abandoned. The volume of blast was therefore maintained steadily at 28,000 cubic feet, and the temperature which before had been quite variable, was maintained more uniformly. At the same time the cinder, which was quite basic, was made less so.

As a result of these changes the output increased to an average of 6050 tons per month, on a coke consumption of 2400 pounds per ton of iron; but after a three months' trial the furnace was suddenly shut down, with a full working burden, for a period of twenty-one days, on account of labor troubles. After it had resumed, and the bad working incident to such a shut down had been remedied, the furnace made an average monthly output of 5700 tons; but the consumption of coke had advanced to 2600 pounds, and continued at that figure till the end of the blast. The furnace was blown out on account of the upper lining being destroyed, after a blast of twenty-three months. The total output for the blast was 118,000 tons, on a coke consumption of 2705 pounds. For the first twelve full months the output was 64,998 tons, on a coke consumption of 2677 pounds per ton of iron.

In Fig. 6 of the drawings is shown a combination of Figs. 4 and 5, in the construction of cooling jackets. From the top of the corset jacket down, the construction is an exact duplicate of the one just described. Between the corset and wrought iron jackets a row of water cooled iron plates is inserted in the brick-

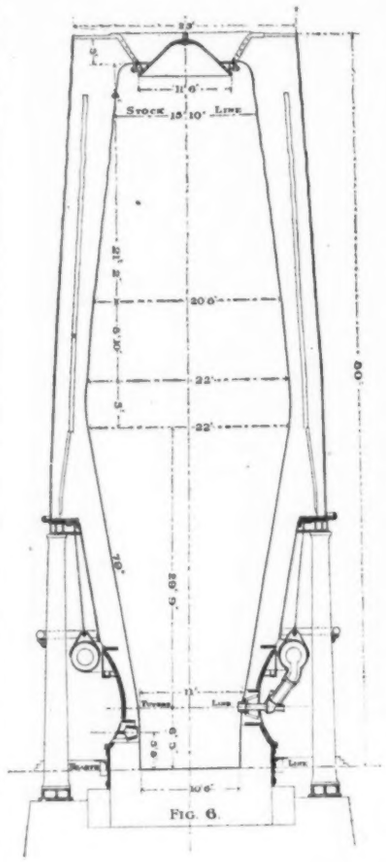


Fig. 6.

work. There were eight sections in the circle, all being connected together, and the water was fed from the high pressure main. The advantage of a high water pressure on this kind of plate is shown by the fact that not a single one was lost during the entire blast.

The interior shape of this furnace differs very materially from those previously shown, having been made to conform, as nearly as possible, to a furnace at the South Chicago works, which was then giving excellent results in regard to both output and consumption of fuel. The bell is increased in diameter, and the upper walls are drawn in, making a less diameter at the stock line. The bosh is 22 feet in diameter, the total hight 80 feet, the cubical capacity, 18,950 feet. There are 8 tuyeres, each 5 inches in diameter.

This furnace was "blown in" in September, 1885, and in one week from starting, the volume of blast was 27,000 cubic feet per minute, and was at this figure when the furnace came under my management. Within the next two months I reduced this volume to 22,000 cubic feet, which was heated to a temperature of 1300 degrees.

The product for October was 6320 tons, and for November 6306 tons, on a coke consumption of 2396 pounds In December, the output on the decreased volume of blast increased to 6451 tons, and the consumption of coke had fallen to 2172 pounds. During the months of January and February, 1886, we were unfortunately compelled to shut down for thirty-three days. In the month of March the output was 6352 tons, on a coke consumption of 2105 pounds. For the first twelve full months the output was 74,475 tons, on an average coke consumption of 2250 pounds per ton of iron. During the last year that the furnace was in blast, the volume of air was gradually increased to 27,000 cubic feet per minute. The inwalls were much worn, and the grade of iron had become variable; but with the increased volume of air, the working became very uniform. In the last eight months of the blast, the consumption of coke had risen to 2500 pounds. After a blast of twenty-six months, the furnace was blown out, having made a total output of 150,374 tons on an average fuel consumption of 2342 pounds per ton of iron. At no time in the blast did the coke consumption reach 2600 pounds, except in the third month before blowing out. The best output obtained in any single month was 6730 tons.

While these records were much better than any previously obtained at the same works, it was evident that had the bosh walls been entirely protected with cooling plates, still better results would have been got. When exterior cooling jackets only are used, the preserving of the furnace lines depends wholly upon the carbon coating which is deposited upon the brickwork as the latter wears away; in fact, were it not for this protection, the bricks would last but a very short time indeed. When this coating increases in thickness the furnace works far more regularly and economically; and in a furnace considerably worn, the thickness of this carbon wall is to a great extent the measure of its economical working. We have repaired bosh walls where only 6 inches of the brickwork remained; but inside was found this coating, 18 to 20

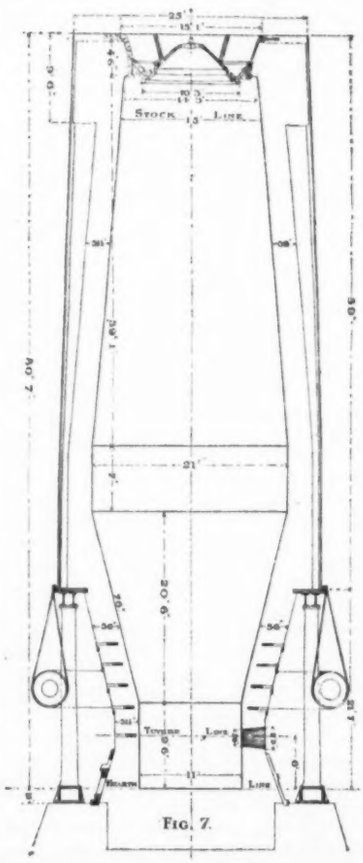


Fig. 7.

inches thick, firmly set, and far more difficult to penetrate with a drill than the firmest brickwork. But, while the thickness of this coating may be increased at will, yet it can only be done at the expense of fuel; and so unstable is the formation, that the expensive operation of building up—extending over months—may be dissipated in a week or two, by running the furnace on an acid cinder.

In Fig. 7 is shown the same furnace as in Fig. 5, with the bosh entirely protected

by cooling plates inserted in the brickwork. A comparison of the two drawings will show the changes in construction. The hearth has been widened to 11 feet diameter. The diameter of bosh is also increased 1 foot, and the stock line is reduced 15 inches. The hearth is protected by water cooled plates, which, from their slanting position, admit of a greater thickness of brickwork at the bottom. These plates are practically automatic, as under an expansion of the brickwork they slide up. In some cases they have raised as much as 3 inches. In the bosh are four rows of bronze cooling plates, eight plates forming the circle, and each plate having two water courses. In the two lower rows each plate is fed separately; in the upper rows two plates are connected together. We have found from quite a number of tests that the water circulating through these plates increases 10° in temperature. Cast iron cooling plates are also placed between the tuyeres, the number of the latter being reduced to seven, 6 inches in diameter. The cubical capacity of the furnace is 17,230 feet.

This furnace was "blown in" in March, 1887, and in April made 5591 tons, on a coke consumption of 2105 pounds. In May and June the output was small, a stoppage occurring on account of a shortage in the coke supply. In July the output increased to 6243 tons, and in September reached 7064 tons, on a coke consumption of 1993 pounds. The volume of air blown was 24,000 cubic feet per minute, heated to an average temperature of 1200°. This furnace continued to do excellent work until the following December, when a stoppage of four and a half months occurred, pending an adjustment of the wage question. In the nine months that the furnace had been in blast previous to this stop—and including the stoppage on account of coke shortage—the fuel consumption did not exceed 2160 pounds per ton of iron. In May operations were again resumed. While the output soon reached the former figures, yet the coke consumption was rarely reduced for any one month—even to the end of the blast—below 2300 pounds. In the period extending from October, 1888, to January, 1890, the average monthly output was 7000 tons, on a coke consumption of 2350 pounds. During this period the volume of air had been increased to 27,000 cubic feet per minute. The temperature of blast was still maintained at 1200°. The average pressure of blast at the tuyeres was 8 pounds. On account of the brickwork in the bosh being very much worn, the furnace was blown out after a run of 2 years, 7 months and 17 days, exclusive of the time the furnace was banked. The output for the blast was 203,050 tons on an average coke consumption of 2342 pounds per ton of iron. The output for the first 12 full months was 72,554 tons on a coke consumption of 2230 pounds. For the second 12 months, during which no stoppage occurred, the output was 83,219 tons. The best output made in any one month was 7680 tons.

It will be seen by the preceding description that the results both in output and economy of fuel have been materially affected by the long stops that the furnace was subjected to. Under a continuous run much better results would have been got.

The advantages of this system of cooling the bosh were very marked, and although quite a number of plates were lost from various causes during the blast, yet, when a new one was inserted, the furnace invariably showed an improvement in its working.

In the next drawing, Fig. 8, is seen the same construction of hearth and bosh applied to one of our larger furnaces. In fact, the furnace just described was remodeled after this one; but for the purpose of comparing two consecutive blasts on the latter, I have placed it earlier. This furnace was built in 1885–86. The total hight is 80 feet; the diameter of hearth, 11 feet; the diameter of bosh, 23 feet. The bell is 12 feet in diameter, and the stock line 16 feet. The cubical capacity is 19,800 feet. The construction of hearth and bosh is the same as in the furnace just described. There are seven tuyeres, each 6 inches in diameter.

The furnace was started in October, 1886. The record for the next three months is as follows:

Months.	Tons.	Pounds coke per ton of iron.
November	6,735	2,128
December	7,494	2,105
January	8,398	1,935

From January to May, inclusive, the average monthly output was 8150 tons, on a coke consumption of 1980 pounds. The volume of air blown was 27,000 cubic feet per minute, which was heated to an average temperature of 1200°. The pressure at the tuyeres varied from 9 to 10 pounds, and was generally the latter figure when the outputs were largest. In June, the furnace was banked for eight days on account of scarcity of coke, as previously mentioned. As this furnace had been doing such excellent work, the others were banked first, in order to give this one, if possible, a continuous blast; but the supply of coke failed, and although the stop was comparatively a short one, yet, as a result of it, the coke consumption increased to 2300 pounds. The monthly output from this time, up to January, 1888, was 7400 tons, when a second stoppage on account of laber troubles occurred. The length of this stop was 67 days; and although the product was exceptionally large, even to the end of the blast—reaching in some months to over 8000 tons—the consumption of coke increased to an average of 2450 pounds.

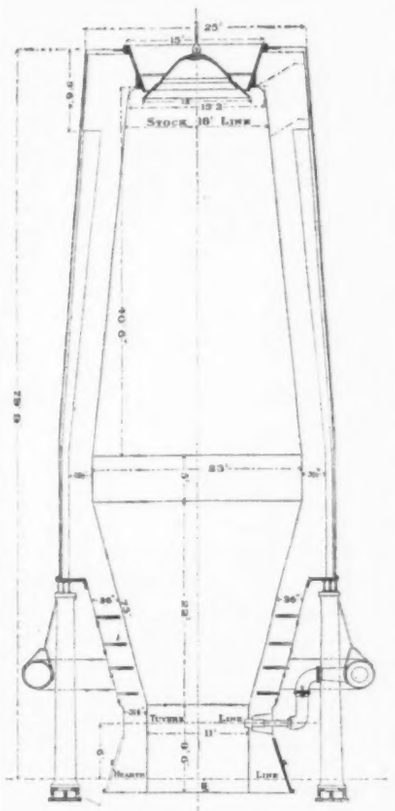


FIG. 8.

It is greatly to be regretted that our work does not show an uninterrupted blast; since our records show, in nearly every case a decrease in output and an increase in fuel consumption from 150 to 200 pounds per ton of iron, as a result of each "banking up."

A portion of the upper lining giving way in August, 1889, the furnace was blown out. The last full month (July) in blast showed an output of 6491 tons. The furnace was in blast—exclusive of the two stoppages I have mentioned—two years, seven months and ten days, and made in that time 224,795 tons of iron, on an average coke consumption of 2317 pounds. The output for the first 12 full months was 88,940 tons on 2150 pounds of coke. The efficiency of the cooling plates in the bosh walls was very marked in this case. The exterior brickwork was in as good condition as at the beginning of the blast, neither a crack, nor a brick forced out of position, showing anywhere. After the stack was cleaned out a careful inspection was made. The bosh walls were found to be in good condition. A measurement at the bosh line showed that the furnace had widened out 18 inches, but with such uniformity that the widest variation shown by the gauge did not exceed 2 inches. From the bosh line to the top of furnace the wear was very much greater. The furnace was relined without delay, and after a two weeks' drying out was put in blast on September 25, 1889, just seven weeks from the time of blowing out. The construction is the same in very particular, except that the diameter of the bosh is reduced to 22 feet, and the stock line to 15 feet 6 inches. The lining runs straight from bosh to stock line. This change reduced the cubical capacity to 18,200 feet. The same number and size of tuyeres are used. The volume of air blown is 25,000 cubic feet per minute, a reduction of 2000 cubic feet from that used in previous blast. Beginning with October, the record of monthly outputs and coke consumption to the present time is as follows:

Months.	Tons.	Pounds coke per ton of iron.
October 1889	6,521	2,450
November 1889	9,097	1,897
December 1889	10,603	1,756
January 1890	10,536	1,737
February 1890	8,954	1,859
March 1890	9,941	1,845
April 1890	10,075	1,847
May 1890	10,035	1,884

The best output for any one week is 2,462 tons. The temperature of the blast averages 1,100 degrees, and the pressure 9½ pounds. The temperature of the escaping gases is 340° An average composition is: CO, 27.5 per cent., CO_2, 11.7 per cent. CO, CO_2, 0.42 per cent.

Counting the time the furnace was running in the first blast, and up to the end of May, 1890, in the second blast, including also the time spent in relining, the period covered is three years and five months, and in that time this furnace has made an output of 301,205 tons, a record which is unparalleled. In the month of May, this, together with a companion furnace of precisely the same dimensions, made an output of 20,192 tons, on an average coke consumption of 1882 pounds per ton of iron. The ores used are from the Lake Superior region, and yield through the furnace 62 per cent. of iron. The proportion of limestone carried is 28 per cent. of the ore burden, and about 1200 pounds of cinder are made per ton of iron. The average analysis of the cinder is as follows:

	Per cent.
Silica	33.00
Alumina	13.00

The stone used contained but a very small quantity of magnesia. The silicon in the iron averages 1.60 per cent., the iron being run into ladles and sent to the converting mill direct. The suitableness of the metal for this "direct process," as we term it, will be appreciated from the fact that under the rigid system of foundry grading—by the fracture—the average

percentage of Nos. 1 and 2 grades from all of our furnaces for the first five months of this year was 95 per cent., and the analyses of 100 ladles, filled consecutively from the furnaces, show an average content of sulphur of 0 023 per cent.

I shall not undertake to say what these furnaces will accomplish on an uninterrupted blast, but I believe the day is not far distant when we shall be able to show a record of 300,000 tons from a furnace in three years, and on a single lining.

In the period covered by the last decade there are three steps in the development of American blast furnace practice that might be mentioned—first, in 1880, the introduction of rapid driving, with its large outputs and high fuel consumption; second, in 1885, the production of an equally large amount of iron with a low fuel consumption, by slow driving; and third, in 1890, the production of nearly double that quantity of iron, on a low fuel consumption, through rapid driving.

In the table above I give a summary of the preceding data.

Designation of furnace.	Year in which furnace commenced the blast.	Cubical capacity.	Volume of air per minute.	Total output from blast.	In first twelve full months.			
					Output.	Average daily output.	Average coke consumption.	Capacity for 1 ton of iron, per day.
		Cub. ft.	Cub. ft.	Tons.	Tons.	Tons.	Pounds.	Cub. ft.
Isabella ..	1876	15,000	....	117,575	28,000	76	3,000	197
Fig. 1...	1878	15,400	16,000	92,128	33,552	91	2,850	169
" 2...	1880	6,396	15,000	....	....	*71	*2,400	90
" 3...	1880	17,868	30,000	112,060	48,179	132	2,859	135
" 4...	1882	21,478	27,000	90,317	65,947	180	2,570	119
" 5...	1885	16,680	†31,000	118.000	64,998	178	2,677	90
" 6...	1885	18,950	22,000	150,374	74,475	204	2,250	92
" 7...	1887	17,230	24,000	203,050	‡72,554	198	2,230	87
" 8...	1886	19,800	27,000	224,795	88,940	244	2,150	81
" 8...	1889	18,200	25,000	.....	§113,000	310	1,920	59

* Estimated.
† After running nine months the volume of air was reduced to 28,000 cubic feet.
‡ The second twelve full months, by reason of a continuous blast, shows an output of 83,219 tons on 2396 pounds of coke.
§ Estimated from record made to date.

Abstract of Results.

Discussion.

The discussion of the above paper was exhaustive and exceedingly interesting. It brought out the wide differences in the construction of blast furnaces in this country and England, and the distinctive features of slow and quick driving. Further than this, much attention was devoted to the different ores, the quantity of coke used per ton and the quantity of air. In fact, all the essential characteristics governing the economical running of blast furnaces received careful attention.

SIR LOWTHIAN BELL

opened the discussion which followed the presentation of Mr. Gayley's paper. He said he was astonished at the results there described, and had applied a formula in order to follow the series of actions and reactions which led to such extraordinary results. His remarks added to the value of the paper, since the subject was looked at from another point of view. He said:

The paper that we have just listened to contains really such astounding information that as soon as I arrived in the City of New York I made it my duty to make certain calculations in connection with the figures which have been laid before you. Had I been asked as to the probability of a single blast furnace being capable of turning out in one week 2500 tons of pig iron, I should have hesitated to believe it. I therefore applied a formula which I generally make use of upon these occasions, in order to follow, if I could, the series of actions and reactions which have led to results of so extraordinary a character. I thought it best to commit my observations to writing, because they necessarily involve the use of a good many figures, and I have found by painful experience that trusting to one's memory in order to place those figures in an intelligent and easily followed series is a very difficult matter, at all events for myself. I therefore will refer to them from the written statement I have before me. I would just observe before I begin with that, that if the creation of the Iron and Steel Institute had been followed by no more important results than the opportunities it has afforded gentlemen occupied in a common pursuit of comparing the results of their individual experience, it has done good work. It has taught us among other things that any knowledge we may impart to each other must not be regarded as a mere gift, but rather as an exchange, the value of which cannot be estimated by the sum of the two, but by an entirely new factor, requiring the conjoint operation of the experience and knowledge possessed by the giver and receiver. It is unnecessary to assure the author of the paper before us how grateful the members of this body must feel for the thoroughness of the work he has performed. The results which have been communicated to us this morning may well suggest the idea whether we have in our previous estimates not overlooked some of the conditions involved in smelting the ores of iron, for we have not only to consider the low consumption of fuel, but the hitherto unparalleled large production of iron from one furnace. Thinking that it might interest others, as well as myself, I have examined the figures given us by my friend Mr. Gayley, and compared them with those of furnaces working under very different conditions, and I hope to be able to show you that it is not necessary to look for any new law to account for what at first sight, no doubt, seems little short of the incredible.

For this purpose I will omit for the present all the first examples quoted in the document before us, and go straight to the last, which Mr. Gayley has properly reserved for winding up his most interesting communication.

The problem before us is to account, if we can, for a furnace producing about five times as much iron as we have hitherto made in North Yorkshire from one furnace, and about twice as much as has been obtained from our hematate furnaces in England of like dimensions. The words "of like dimensions" of course you must keep visible before you. And all this has been performed in the particular case before us with an expenditure of 16.80 hundred weight of coke per ton of iron of a high average quality. The consumption of coke per ton of iron depends, of course, as well as its quality, on the more or less perfect manner of its combustion, or on the amount of work it has to perform. Now, so far as concerns Connellsville coke, which is what was used in the case before us, there is nothing whatever to be set down to superiority of quality; for, instead of containing from 5 to 7½ per cent. of ash, like the coke of Durham, it has rarely less than 10 per cent. of this impurity.

The completeness of combustion of the carbon we have to deal with, of course, is judged by the amount of carbonic acid in the gases. Now, when we compare the heat obtained from each unit of coke, partly because the carbon as carbonic acid is in relation to that as carbonic oxide slightly below that which is often found in the gases from a Cleveland furnace, partly because the temperature of the blast is not quite so high, and partly because of the larger percentage of ash being higher in the American than in the English coke. The effect of this is evidenced in the following figures:

One unit of coke afforded of heat:	Cleveland. Calories.	Lucy. Calories.
Carbon burnt to carbonic oxide	2,032	1,898
Part of above burnt to carbonic acid	1,672	1,626
Heat in blast	727	596
Total	4,431	4,120

Showing a difference of 7½ per cent. in favor of the Cleveland furnace. I will here mention that in my estimates I always make use of the centigrade system.

It is, therefore, perfectly clear that whatever might have led to the extraordinary performance of this furnace, we cannot look for it in the quantity of heat yielded by the coke employed. It may be here remarked that the relation between carbon as carbonic acid to carbon as carbonic oxide in the Cleveland furnace is as 1 to 2.11 against 1 to 2.25 in the Pittsburgh furnace. On the other hand, the actual quantity of carbon as acid is in the former 5.97 hundredweight, against 4.99 hundredweight in the latter furnace. The generation of carbon being almost entirely due to the oxidation of carbonic oxide by the act of reduction, the difference in the Pittsburgh furnace is due to the carbonic acid generated being returned to the condition of carbonic oxide, involving thereby a loss of 5600 units or thereabouts per ton of iron. I believe 5.97 hundredweight of carbon as carbonic acid per ton of iron is about the full quantity capable of being produced by the reduction of the ore, but if this quantity was present in the Pittsburgh furnace we should have for each unit of carbon as carbonic acid 1.75 only present as carbonic oxide, which is a condition of things I suspect to be unattainable in the production of gray iron.

I would remark just at this point that it will be observed that the temperature of the blast by no means accounts for the very great performance of the furnace itself. It is given here at 1100°, which, in point of fact, is 593° of the centigrade scale. Now, I believe, and I should like my friend Mr. Gayley to ascertain this for himself—I believe that if you increase the temperature of the blast it is quite probable no beneficial results would follow that alteration, because you would merely proceed to turn back again a certain quantity of the carbon as carbonic acid into the condition of carbonic oxide. In other words, the gain in the blast would

be sacrificed by the efficiency of the coke itself.

The furnace with which this Pittsburgh furnace has been compared performed its duty under an entirely different class of circumstances, as may be seen by the two columns of figures which follow: Now, at the risk of being a little tiresome, I would just ask you to follow the figures from which I have calculated the performance of the furnace itself. I give you the figures in the first instance of the Cleveland furnace, and in the second of the Pittsburgh:

	Cleveland.	Pittsburgh.
Cubical contents	15,500	19,800
Temperature of blast	704° C.	593° C.
Coke consumed per ton of iron	19.99 cwt.	10.71 cwt.
Limestone per ton of iron	11.00 cwt.	16 80 cwt.
Ore	48.00 cwt.	32 23 cwt.
Weight of blast per ton of iron	87.15 cwt.	71.20 cwt.
Weight of gases per ton of iron	119.47 cwt.	100.10 cwt.
Temperature of gases	250° C.	160° C.
Tons of iron per 1000 cubic feet space of furnace per week	22.00	117 00
		3½ years, 2333
Slag per ton of iron	28.00	10.71
Calories produced per ton of iron	88,577	69,244

The differences in the various factors are met by corresponding variations in the appropriation of heat under the various items. Of course it is not necessary to point out to you that if one furnace has 28 hundredweight of slag to melt against another furnace which has only 10.71 hundredweight there must be a distinct gain. All these factors I have set forth in two columns, and to these factors I have added their representation in coke.

	Cleveland coke.		Pittsburgh coke.	
Reduction of peroxide of iron	33,108	7.47	33,515	7.90
Reduction of metalloids in pig	4,174	0.94	520	0.12
Dissociation of carbonic oxide	1,440	0.33	1,920	0.46
Fusion of pig iron	6,600	1.49	6,900	1.61
Evaporation of water in coke	275	0.06	240	0.06
Decomposition of water in blast	2,380	0.54	2,238	0.54
Expulsion of carbonic acid of lime	4,070	0.92	2,980	0.72
Reduction of this carbonic acid to carbonic oxide	4,224	0.95	3,488	0.85
Fusion of slag	15,400	3.48	5,860	1.43
Carried off in gases	7,166	1.60	3,796	0 93
Heat lost by radiation, convection, tuyere water, &c.	9,740	2.21	8,987	2.18
Total	88,577	19.99	69,224	16.80

A very important source of loss of heat may be involved in that carried away in the escaping gases, and the lessening of this bears directly on the large make of the furnaces referred to by Mr. Gayley and accounts for a large proportion of the saving effected by the hot blast. Then when furnaces of 48 feet in hight were blown with cold air, nearly 25 per cent. of the effective heat of the coke, say 9 hundredweight, was carried off in this way. In heating the blast to 485° C., one half of this was saved, and by doubling the capacity of the furnace the loss was reduced to less than 2 hundredweight of coke. In point of fact, instead of being 9 hundredweight it was 2 hundredweight. So far as these Pittsburgh furnaces are concerned, I have since my arrival at New York heard the large make and the economy of fuel set down to the facility with which the Lake Superior ore was reduced. In my opinion this is an error. In my experiments I instituted a large number of comparative trials of the readiness with which different ores part with their oxygen. Of all, I believe the ore from Cleveland Hills retains its oxygen with the greatest tenacity, but in spite of this, reduction so far as it is effected in the upper zone is accomplished during its passage through the first 10 feet of its descent in an 80 foot furnace. I have, it will be perceived, limited the amount of reduction effected in these 10 feet of depth because I think a large amount of oxygen,—about 25 per cent.,—is retained until the region of the tuyeres is reached. Into the cause of this time will not permit me to enter. One cause of the gases escaping at a high temperature is the undue rapidity with which they pass through the solids during the descent of the latter. From this it might be inferred that in the Pittsburgh furnaces, in their rapid driving there would be a tendency to a great loss from this cause, whereas the contrary is the fact, seeing the gases for each ton of iron are fully four times as great in them as in those of Middlesborough.

The mode of accounting for this apparent anomaly is the only question left for me to bring under your notice. To do this, we may neglect the chemical action going on in the interior of the furnace, and consider the cooling of gases as effected by their meeting, during their ascent, the descending current of cooler solids.

Let us suppose a tall vessel filled with fragments of small balls, say of calcined Cleveland ore. A current of hot air is passed through them; in time the air will flow out of the top at about the temperature at which it enters, the difference being due to loss through the sides of the vessel. We now commence to withdraw the balls say at the rate of 20 in a minute, adding a similar number at the top. The escaping current is slightly cooled, which means that a loss of heat at the top is still going on, but the balls withdrawn are still at a high temperature. We increase the rate of withdrawal to 200 per minute, by which the gases fall to atmospheric temperature, but 200 balls being too much for the current of hot air to raise to the desired temperature we must retard the rate of withdrawal until the desired elevation is obtained. It follows from this experiment that there is a given ratio somewhere between 20 and 200 balls per minute which gives the best results.

In an old blast furnace of 6000 cubic feet, smelting Cleveland ore, 36.7 tons of iron were weekly made per 1000 cubic feet of capacity. The temperature of the escaping gas was 451° C., the blast being 485° C. The loss in coke was 5 hundredweight in the escaping gases. After increasing the capacity to 15,500 cubic feet the loss from this cause was reduced to 2¼ hundredweight, but instead of obtaining 36.7 tons of iron per week per 1000 feet of capacity, we only got 2.2 tons. The heat intercepting power of our furnace charges being equal to reducing the temperature of the gases to 310° C.

It is quite reasonable, however, to suppose that materials might be introduced at the top which have a more powerful heat intercepting faculty than Cleveland iron. I believe that your compact ore containing one-half more iron than ours possesses this property and in consequence your gases escape at a temperature of 160, which I estimate represents a loss of 93 hundredweight of coke.

It is, therefore, a question, in my opinion, of the heat absorbing power of the burden used in these furnaces which can account for the results mentioned, and I have no hesitation in giving it as my opinion that if we were to attempt to drive our Cleveland furnaces at any such rate we should be disappointed in the result. I may mention, what is well known to gentlemen who I see before me, that we have a very enterprising firm with us, the head of which is my friend Charles Cockran. Mr. Cockran has a very large furnace; he is making 800 or 900 tons of iron in a week, and sometimes great surprise is expressed at what he is doing, but those gentlemen who express their surprise apparently overlook the fact that Mr. Cockran's furnace has a capacity of above 33,000 cubic feet, and the result is that taking the amount of iron made after those feet of capacity his furnace is doing very little more than a furnace of half the capacity—I mean ratably.

It the rate you are driving represents the positiom of the equilibrium I am describing—that is, that it is the counterpart of that position between 20 balls and 200 balls per minute which produces an equilibrium—you will lose heat and waste coke either by driving more slowly or more quickly than you are now doing.

E. S. COOK, OF POTTSTOWN,

brought forward another feature of great interest. He described the work done by smaller furnaces using anthracite fuel. The account of the construction and method of operation common 20 years ago was followed by a description of the changes which had taken place and of the perfected practice of to-day. His remarks were in part as follows:

A few days ago Mr. Gayley kindly sent me a copy of his paper, with the request that I should be prepared to make some remarks. After a careful reading of his paper, I concluded that he had about exhausted the subject, at least as far as the coke practice is concerned, when a single furnace of 18,000 cubic feet capacity can be made to produce 113,000 gross tons of iron in one year with an average fuel consumption of 1920 pounds coke per ton of iron. It has occurred to me that while Mr. Gayley has so fully treated of the large and splendidly equipped furnaces, using coke fuels and burdens of the rich lake ores, the advancement by the smaller furnaces using anthracite fuel might not be without some interest. Since 1883 the use of a portion of coke has become almost universal in the anthracite districts. Many furnaces, while in close proximity to the anthracite fields, use coke fuel exclusively, so that of the 1,793,639 tons credited to the anthracite districts for 1889 only 344,358 tons were made from anthracite exclusively. It would thus appear that the anthracite iron industry is a decaying one, soon to disappear from the face of the earth, unless the coal railroads adopt a more liberal policy for the future than has characterized them in the past. Coke fuel costs more per ton in the districts referred to than coal. The preference shown to the former as a blast furnace fuel is due to the greater ease with which the furnace is controlled and the less risk of costly scaffolds and chills. No one not practically acquainted with the subject is likely to appreciate the difference in the actual management of furnaces using coal and coke respectively. The difficulties attending the former greatly exceed the latter. At the same time, if the anthracite furnace is successfully and economically handled, the profits are greater or the losses smaller than if the more expensive coke is used.

As the Edgar Thomson Furnaces fairly represent the progress in coke practice, the Warwick Furnace, at Pottstown, Pa., may illustrate the improvement in the anthracite practice, although it is by no means alone in the work. I assumed the management of this furnace in December, 1877. It had been built and first blown in during 1875 and with indifferent success, averaging about 20 tons of iron per day The furnace was originally 16 feet bosh, 55 feet high. The bosh line was afterward reduced 6 inches, and the hight increased 6 inches, the capacity being about 5500 cubic feet. Previous to 1878, furnaces of this size were making from

150 to 250 tons per week, the latter figure being considered rather exceptional. From 1¾ to 2 tons gross of coal per ton of iron was about the average fire consumption. The Warwick Furnace in 1878 produced 17,148 tons of 2268 pounds, an average of nearly 330 tons per week, using 2912 pounds coal per ton of iron. The ore mixture yielded 45.4 per cent., and the furnace was blown with 8300 cubic feet of air per minute, heated in iron pipe stoves to 855°. For 1879 the product was 19,387½ tons, or about 375 tons per week, with 2912 pounds coal per ton of iron; ores yielded 44.7 per cent.; 8300 cubic feet air per minute heated to 850°. The blast terminated in January, 1880, the furnace having run 107 weeks and making 37,400 tons of iron. In starting he blew in on an old inwall. At the time this work was quite a revelation, so far as the use of anthracite fuel was concerned and was the subject of wide remark, occurring, as it, did about the time the Lucy Furnace, at Pittsburgh, was showing the possibilities of coke and creating a stir in the iron circles, not only of that vicinity, but of the country at large as well.

It will be well to bear in mind that, at this period, chemistry was but sparingly employed, only a few furnaces, Warwick among the number, making use of the help afforded by analysis. The furnace was relined, no particular changes being made in the construction, and blown in the latter part of March, 1880. We started off well enough, making about 400 tons per week; but the blast was of short duration. During this year the adverse critics of the improved practice apparently had the best of the arguments. The manager was placed in an embarrassing position, though firm in the belief that all would come out right in the end, and yet as "success is the best evidence of success," he could not then offer the convincing proof.

In 1875 the furnace was built with bosh walls 5 feet thick, strengthened by upright brick staves. This construction was retained in 1880, as light bosh walls were then unknown, or, if considered at all, were looked upon as a hazardous experiment. With the increased volume of air blown and lower fuel consumption, the brick melted rapidly, forming huge pockets or cavities above the tuyeres. These filled with finely divided ore and coal dirt, and this mass, slipping at once into the crucible, chilled the furnace. Had we then been as well informed as to the use of the oil blow pipe as in later years, and a device only used at our furnace, turned the tuyere slagging valve, the mortification of a chilled furnace could have been avoided, although it is not probable that the furnace could have been profitably run. The only way I can account for the previous blast not developing the same trouble is from the fact that for the first month of the blast the furnace was excessively gray. The bosh walls became heavily coated, evenly distributed, fortunately, with a graphitic covering. This protected and preserved the brickwork, and kept the boshes in good shape. When the furnace was blown out the existence of this coating was plainly evident. It proved to be a blessing in disguise, when I recall the anxiety and worry caused by the overheated condition of the furnace.

Not to prolong this ancient history to too great a length, recounting the trials of 1880, I will simply say that the bosh was finally filled with vertical coils of 1-inch pipe, encircling the whole circumference and extending about 10 feet or so above the tuyeres. These coils were supplied with water, which was kept in constant circulation. The exterior being in good condition was not disturbed. The pipes were placed against the melted brick face, and from 12 inches to 18 inches of new brick protected them from the contents of the furnace. This was the first instance, in our vicinity at least, of a water cooled bosh; and many were the curious comments upon our placing the furnace in a spring of water. The furnace was blown in in December, 1880, and continued in blast 245 weeks, making 101,335½ tons, or 413.6 tons per week. This was an unusual total for an anthracite blast.

For the entire blast of 245 weeks, the ore mixtures averaged 50 per cent.; fuel per ton of iron, 2912 pounds; air per minute, 8750 cubic feet, heated to 865° The best average for three months shows 600 tons iron per week with a fuel consumption of 2212 pounds per ton of iron. The furnace was repaired in the fall of 1885. New hot blast stoves were built, four sections of the Durham pattern, 6240 square feet of heating surface replacing the two small stoves of only 3600 square feet of heating surface. The thick bosh walls were dispensed with, 22 inches of brick strengthened by ½ inch wrought iron jacket being adopted instead. The bosh coils or water cooled pipes were retained, being placed between the jacket and the brickwork. The capacity of the furnace remained almost 5500 cubic feet. We blew in in December, 1886, and blew out May 28, 1889. During the blast of 180 weeks we made a total of 107,595½ tons of iron, an average of nearly 600 tons per week. The ores for the blast averaged 53 per cent.; fuel, 2665 pounds per ton of iron; air, 11,050 cubic feet per minute, heated to 884°.

Up to June, 1889, no change had been made in equipment or size of furnace since 1875, except the enlarged hot blast stoves and an extra set of boilers to avoid stoppages for cleaning, one set being idle all the time.

During the summer of 1889 the old furnace stack, brick banded with iron, was torn down and a new steel shell erected, 16 feet bosh, 70 feet high, with crucible 8 feet 9 inches in diameter. Cubic capacity about 8400 feet. A large Weimer engine and extra boilers were added to the equipment. We blew in October 6, 1889, and have been in blast now nearly one year. The product will approximate 40,000 tons, the average fuel consumption to date being 2464 pounds per ton of iron, ore mixture 55 per cent., air per minute 14,000 cubic feet heated to 900°. The largest work for any one month so far averages 823 tons per week, with 873 tons as the best week. The lowest fuel consumption for any five consecutive weeks 2268 pounds per ton of iron. For the first year of the enlarged furnace 76.4 cubic feet of capacity has made one ton of iron per day, the largest week showing 67.4 cubic feet capacity per ton of iron per day, which is somewhat above the average of the smaller stack. Before the blast is completed we hope to improve the record. Heretofore the second year of a blast shows the best results. Whether the same will hold good this blast remains to be seen.

ALEXANDER THIELEN, OF RUHRORT, GERMANY.

mentioned the difficulties ironmasters of his country had to contend with and the differences in the ores they had at their disposal. He gave an account of the construction and practice there found to be most advantagous. He said:

I am only going to offer a few remarks on Mr. Gayley's paper, and I wish to point out to you the conditions under which we have to work our blast furnaces in Germany. I am speaking now more particularly of the Northern District, the lower Rhine and the Elbe, which, as you know, are the principal iron making district of Germany. On the lower Rhine we have ores at our disposal containing on an average about 45 or 46 per cent of iron, consisting chiefly, for the basic process, of Dutch bog ores, of burned pyrites, of old salts of the "blue billys," being a mixture all through containing very small inclosed ores. If we intend to work our blast furnaces so as to get a production of about 10,000 tons monthly, like the Lucy Furnaces do, we should have to send through the furnaces within the month a very much larger quantity than they would have to do at the furnaces of the Messrs. Carnegie. If we take an output of 10,000 tons of iron, and say that the ores at the Lucy Furnaces contain on an average 63 per cent. and that the addition of limestone is something like 25 per cent., it means that the whole mixture going to the blast furnace will consist of 14,000 tons of ore and about 3500 tons of limestone, making together 17,500 tons. Now, in Germany, if we take our average produce of ores, say at 47 or 48 per cent., it will come to 22,000 tons of ore; and we have to add 33 per cent. of limestone, which will be another 7100 tons; so that in fact we would have to send 29,400 tons of iron ore and limestone through the Furnace to get a production of 10,000 tons of iron. If we take the reduced quantity of iron contained in our ores, and if we should work under the same circumstances as the Lucy Furnace does—that is, if we were going to send the same amount of mixture through the furnace, then we should only have a monthly output of 6200 tons.

Now, there is another difference which makes it utterly impossible for us to follow the example which the American blast furnaces set up. We have to fall back on our native ores, which, as a rule, as I have told you, are very small. We have more than 25 per cent. of ore in our blast furnaces which is in a much finer state, I will say, than peas, and sometimes as fine as snuff; and we should not be able to work the furnace at such heats as they work on the Lucy Furnace. We are limited, as long as we do not get other ores, to our blow furnaces. Not very far off from our district we have a great body of oolitic ores, but so far we are prevented from using this ore because we have no proper means of communication.

I understand that you in America bake your coke for something like 96 hours. We only do so 48 hours; and the quantity of coke used is considerable smaller than the quantity of coke used in the Lucy Furnace. Although we only have 48 per cent. of iron in our ores as compared with 63 per cent. in the Lucy Furnaces, still we do not use more than 1700 weight of coke. If we should have ores of 63 per cent. then of course the 1700 weight of coke might be reduced materially. There is another difference which makes it impossible to follow the American lead. We have to work for our Bessemer ore our basic conductors, and our managers of the Bessemer or basic conductors require at the very least 1.8 per cent. of silica, whereas our American steel workers are quite satisfied with .06 or .07. We tried to follow this example of our American steel friends, but found it utterly impossible to do so. There are many reasons for our not succeeding, but I will not fatigue you with those more fully. I may only mention that we have much larger facilities than the Americans have got; that we work with a different system; we work directly from the blast furnaces; while the Americans work through the cupola furnaces, and get greater initial heat from the cupola furnaces than we get; and so we must keep the amount of silicon up to 0.8 per cent. And besides that, we are not quite satisfied with relining our furnaces every three years. It is a very costly affair to do so, and we have so far managed to keep our furnaces

from 13 to 17 years, and at the present time we have several furnaces working in the sixteenth and seventeenth year, and they still give us very satisfactory results. We greatly admire the Americans, and on what a prodigious scale they can turn out everything here in this country! But nature has here with such an open hand showered its treasures of ore and coal upon them, and they have such beautiful qualities of ore at their disposal, while we have to do with those we find at our hands.

E. W. RICHARDS, OF LOW MOOR, ENGLAND,

considered the objects aimed at by this fast driving. The rate is influenced by the demand of the owner for more tons of pigs and the endeavor of the furnace manager to "beat the record"—of course that is to be done "at the lowest possible cost." He compared the internal formation of English and American furnaces, and attributed the increased output here obtained to the greater hearth diameter. He considered the several furnaces described, and spoke as follows:

This history of the development of blast furnace practice in and about Pittsburgh is a most interesting one. Mr. Gayley's paper and Mr. Cook's statement show that there has been an abundance of experience in blowing in and blowing out blast furnaces. What are the objects and what are the inducements for this excessive driving? The paper shows us that the cost of doing so is enormous. Labor is dearer in America than in England, so that as much work must be got out of it as possible. But I believe that the charger at the Cleveland blast furnace handles as many tons of material as flesh and blood can do well and keep up all the year round. So that if the production of a blast furnace is to be doubled double the number of men must be employed, so that it seemed difficult to understand how this excessive driving can reduce the cost of labor very much. It is probable that an explanation may be found in the satisfaction felt by the owner in a margin of profit which is so pleasant to see that he instructs his blast furnace manager to give him tons of pigs—of course at the lowest possible cost—but to give him tons of pigs. Then there is another reason for this fast driving which to those engaged in it has a great fascination, and is a constant stimulus to exertion—a stimulus much indulged in here: I refer to the practice of trying to beat the record. Captain Jones was a man of great ability, industry and energy; and we, who knew him well, sorrow to-day that he has passed away from us. I had the pleasure some nine years ago of visiting with him the South Chicago Works. At that time they had a new and magnificent plant of blast furnaces. Mr. Potter had arranged a most powerful equipment of stoves, blast engines, and several batteries of boilers. Captain Jones sent home to say: "Those boys at Chicago intend to beat our record." And they did. Then the boys at the Edgar Thomson works made their powerful plant still more powerful, so as to beat the boys at Chicago. And so they went on, until in 1885 Mr. Gayley tells us that they forced in the enormous volume of 31,000 cubic feet of air per minute, at a pressure to the blast of over 9 pounds per square inch, and so overdid it that they burned 2677 pounds of coke per 2240 pounds of iron produced, and shortened the short and merry life of the blast furnaces. The members of the Institute will inquire when at Chicago, and will be very curious and interested to know who has the record now,—whether Mr. Carnegie or Mr. Potter. If Mr. Carnegie has it he will probably be content with 100,000 tons of pig iron per furnace per annum. But the furnaces themselves will have to be of a very greatly increased capacity to work economically, having boshes from at least 28 to 30 feet in diameter, provided always that there is a sufficiently pleasant margin of profit in the transaction.

It will be interesting to make a short comparison of the internal formation of the furnace described in this paper, and to know where and how they differ from the English forms, so as to show what has enabled the American practic to produce what are really astonishing results. We are at once struck by the much larger diameter of the hearth of the American furnace, and it is primarily due to this enlargement of the hearth that the increased output is obtained. But this would be of no great advantage had not the pressure and volume of the blast been at the same time very largely increased. Look at the forms of the furnaces Nos, 2, 3 and 4, and you will see that they have very steep and narrow boshes, which my experience has led me to regard as extremely bad forms, so bad that a furnace with a steep and narrow bosh of 84 degrees, as on No, 3, could not work well and make a regular quality of iron at what we must now term, I suppose, slow driving. Indeed, such a form necessitates fast driving so as to keep the materials in motion and prevent scaffolding. Steep and narrow boshes favor the formation of an arched scaffold much more than a flatter bosh. The latter gives an arch of larger radius, much more difficult to form. This arched scaffold gives great trouble when the slip takes place. No doubt the English bell of from 11 to 12 feet diameter is better and much simpler than the complications which are shown in Fig. 3. One is gratified to see that Mr. Gayley has discarded this arrangement. The adoption of the 11-foot bell gives a 2 foot space all around for the material to pass. A diameter of throat 11 to 12 feet is a good proportion for a 22-foot bosh. I am not at all in favor of small boshes. The descent of the material in the cylinder is made difficult through close packing, so that the diameter from the throat downward and from the top of the bosh should constantly increase and so release the material from a too close contact, and permit the free passage of the gases. This arrangement at the same time tends to increase the diameter of the bosh, giving greater capacity to the furnace, and favoring a greater production, with less forcing. Mr. Gayley has recognized this, because I observed yesterday when he was reading his paper that he said: "From the bosh line to the top of furnace the wear was very much greater." Then a few lines further on he says: "The lining runs straight from bosh to stock line." I advocate more that form—making a 15-foot throat, and tapering down to a very large bosh, so that the materials unpack themselves, and the gases pass readily through. The angle of the bosh should, in my opinion, not exceed 75°, and may with advantage be as low as 70° if the bosh is about 22 feet diameter.

We now come to the No. 8 furnace, the lines of which show a return to the English form, with the exception that the tuyeres are placed higher up. I would suggest that if the two great works before named still purpose continuing to compete for the record, the one which adopts the greater cubical capacity will win. Mr. Potter, of Chicago, has already contributed so much in bringing about the brilliant results now recorded that this 2d day of October, 1890, will in the future be considered an epoch in blast furnace practice, and will be pointed to and cited as the goal obtained after years of thought and labor by many who have devoted time and vast sums of money to reach it. It would be of great service in this discussion if Mr. Potter would give us the results of his experience; for it must be evident that, being such a distance from supplies of fuel, he would give much attention to economy in that direction.

There seems at the present moment to be a lull in the race of the rivals. They seem to have got as much out of 20,000 cubical feet of blast furnace as can be got with economy; and we have before us the fact that a furnace using 60 per cent. of mineral produces 2000 tons weekly, with a very low consumption of 1920 pounds of coke per ton of 2240 pounds of pig iron made, which is a result of a highly satisfactory character, and it reflects the very greatest credit on the owners and managers, and one of which they may justly be proud. There is a very interesting feature arising out of this rapid driving. We know quite well that a blast furnace settled down in the course of a couple of months to a certain rate of driving, which gives a regular quality of iron, as in the case of the furnaces making Cleveland iron, 60 per cent. of which is No. 3 quality, with a yield of 2000 weight of iron to 2000 weight of coke. Now, if that furnace be driven without increasing the coke, the quality of iron immediately falls off, and you have probably No. 4 forge; and if driven a little faster yet it falls to white iron. But the American practice of doubling the production with nothing exceptional in the temperature of the blast makes a ton of Bessemer iron to considerably less than a ton of coke—a result I believe never before attained. We must presume that this economy of fuel was an accidental outcome of fast driving. At what point of production was this observed? I have constructed several blast furnaces, some with hearths 10 feet in diameter and some with 11 feet, and have made Bessemer pig iron for steel making purposes up to 1000 tons weekly, without remarking any special economy; indeed, rather the contrary—although the temperature of the blast was maintained at about 1400°. Is it more desirable or more economical to drive a blast furnace at a speed of 2000 tons per month, the wear and tear and all things considered, than to obtain that production from two furnaces? Of course we know that it is simply the shell of the blast furnace that is under consideration. You must have a certain number of stoves to heat the blast and a certain number of blast engines in order to give you the fuel required; and you must have the requisite number of boilers to work those engines. So that it is simply a question of the outer shell of the blast furnace that we have to consider. And so I ask, is it desirable, all things considered, to drive the furnaces at such a rate, the paper showing us that the cost of doing so is enormous? Is the iron, when the furnace is driven rapidly, producing 2000 tons per week, as uniform in quality as when driven at 1000 tons? It is my belief that it is, because I find when going at from 600 to 1000 tons per week that the quality was as good in making 1000 tons as in making 600. And so one might infer that the quality would be as good when making 2000 tons as when making 1000. But, some may ask, if this is so, why has it become necessary to adopt the system of storing several casts of molten iron taken from two or more furnaces in a large vessel, termed a mixer, before the iron is considered of fit quality to be sent to the Bessemer converter? There are some other points in this paper that I feel quite sure some other blast furnace manager will talk about, and so I will not bring them before you.

The discussion on Mr. Gayley's paper was continued by

E. C. POTTER, OF CHICAGO,

who described the work done by a furnace of the Illinois Steel Company. He had

found that small furnaces had given larger outputs than the large ones in comparison with their cubical contents and fuel consumption. He described the construction followed at South Chicago. Mr. Potter said:

I am sure my friend Mr. Richards had no intention of precipitating a Kilkenny cat fight between the Pittsburgh boys and the Chicago boys. I want to assure him that the rivalry is a most generous one, and that each of us, I think, has gained mutual advantage from our mutual comparisons of work. I want to say, though, that we have a record of the furnace practice at Chicago which I think will compare favorably, perhaps, with the magnificent work of the Edgar Thomson Furnaces, although the figures are not quite so large; still in comparison with the size of the furnace I think they will furnish considerable food for reflection as to whether the very large furnaces are the ones with which we may expect to obtain the highest possible economy. This record, I am sorry to say, was not accomplished by the furnaces at South Chicago, but by one of the furnaces at the Union plant of the Illinois Steel Company. This furnace is a rather small one compartively, containing about 8800 cubic feet capacity. This furnace has made this year in a single week 1414 tons of Bessemer iron; and in a month over 5800 tons; and this rate of going on has been continued for several months, showing that it is not merely a spurt. The fuel consumption for this month was some 50 tons more than the lowest Mr. Gayley has obtained—namely, 1680 odd pounds; I don't remember exactly, but in that neighborhood.

The question that presents itself at once to my mind in considering the performance of this furnace, and not only this one, but considering all of the 15 furnaces now owned by the Illinois Steel Company, is that we have found that invariably the smaller furnaces show much the better work in regard to outputs in comparison with their cubical contents and with their fuel consumption. The performance of this furnace that I have just cited shows a product of nearly 2¼ tons of iron per each 100 cubic feet of capacity per day. Mr. Gayley's furnace to equal this must make over 12,000 tons per month, and I do not think even the most enthusiastic American can consider that quite possible in the light of our present knowledge. It seems to me, therefore, from these records (and they are borne out by our practice in Chicago and the West) that the moderate sized furnace, say from 10,000 to 12,000 cubic feet capacity, must be the one from which you may look for the best records, considered economically. I cannot say that I have come to that conclusion definitely as yet, as we have now under construction at South Chicago a new plant of furnaces of the largest size — the same size practically as those of Mr. Gayley. These are 85 feet in hight, 21 feet bosh diameter, with a cubical capacity of about 18,000 cubic feet. Until we have operated these furnaces and determined just what they can do in comparison with smaller ones, I must withhold my judgment as to which is the better sized furnace for economical work. Of course in considering this locality plays a very large part. I think that in the case of the Edgar Thomson plant and its proximity to the coke region, where the fuel saving is not so great an item as it is in the West, undoubtedly a very large furnace, a very large output, reducing thereby the labor cost per ton and the item of general expenses, is the one for that locality; but for the West, Chicago particularly, we must save fuel. That is the paramount feature of our furnace practice.

I have noticed with very much interest Mr. Gayley's experiments in his furnace lines, and also Mr. Richards' remarks on the same, and I must say that I am entirely in harmony with Mr. Richards in his criticisms on the furnace lines. We have done considerable experimenting at South Chicago, more particularly in this direction, and it has been entirely in the direction of lowering the bosh of the furnace. The furnaces described in my paper before this institute four years ago, as some of you remember, were of the high, steep bosh kind. These gave very good results as to driving and as to fuel economy; but the serious fault that we found with them was that for certainly the first six months of their life we had considerable trouble, as Mr. Richards prophsied, with sticking and hanging and scaffolding, until the furnace had cut its own lines. Then during the first six months of the second year we usually got our best work out of these furnaces. To overcome this we lowered the bosh of the furnace on relining, from 35 feet above the hearth level to 26 feet above the hearth level, all other dimensions being the same. We flattened the angle of the bosh from 81° to 72°. These furnaces behaved very well in regard to the scaffolding and hanging, we never having had an hour's difficulty on that score, but the furnace absolutely refused to drive, and consequently we did not get as good fuel results as we did from the rapid driving furnaces. This, of course, was a fatal feature with our Chicago practice. To overcome this we have this year put in a blast furnace with lines modified from these last, by leaving the bosh hight the same, 26 feet, and widening the hearth from 11 to 12 feet, giving us our old bosh angle of 81°. This furnace seems to have accomplished all that we have expected and has been working very smoothly from the day of its going in, and driving with reasonable rapidity and getting very good fuel consumption. These two furnaces are worked side by side now, and the last furnace I have spoken of is making from 100 to 150 tons per week more than the other. So that it seems to me that we have very nearly solved the question of furnace lines for the material with which we have to work.

G. J. SNELUS, OF ENGLAND,

compared the work done by the furnace described in the paper and those of England and the point of difference in size, form and method of operating. He also discussed the question of rapid driving. He said:

It was a great advantage to us Englishmen to have this paper of Mr. Gayley placed in our hands before we started on our voyage, for it gave many of us an opportunity of carefully considering the paper, which we certainly could not have done amidst the festivities in which we have been called upon to partake since we have arrived here. I have endeavored to find out the reasons for this wonderful production and for this economical production of pig iron. The large yields, three times as much as we are getting from furnaces of nearly or quite equal capacity in England, with a saving of 20 per cent. of fuel, is, I venture to say, a point which we Englishmen cannot afford to overlook, and if we can find out the reason why these results are obtained by coming this long journey, I am quite sure we shall be amply repaid for our work. I have endeavored to make a comparison between all the several points in the practice with this Lucy Furnace with our own practice in England; and I will take the items one after the other, as rapidly as I can.

First, with regard to the shape of the furnace. I am very pleased to see that the No. 8 furnace, which has given these wonderful results, is a return to the lines of most of our good English furnaces. Mr. Richards has already called your attention to this, and I can say for myself that if you were to place our West Cumberland lines upon the No. 8 furnace you would find that they would agree with them in all particulars, except that the furnace is smaller. The angle of the bosh is identical—75°. The position of the bosh is identical. The proportion of the hearth to the bosh and to the hight of the furnace is about the same. So that as far as regards the shape of the furnace, I cannot see much to account for the improvements which we have met with.

Then with regard to the fuel. Sir Lowthian Bell has said that our fuel is better than they have at the Lucy Furnace. I am afraid I cannot say quite so much for what we get on the West Coast, but still it is not much worse. We have a coke there which contains roughly, on the average, about 10 per cent. of ash and from ¾ to 1 per cent. of sulphur. That is about the average of the coke we get in West Cumberland; and I think that is about the average of the Connellsville coke. So that we may put fuel to one side as not contributing to this wonderful result in any great degree.

Then with regard to the ore. We are told that the ores yield 62 per cent. of metallic iron. Our Cumberland ores do not yield so much as that. They yield perhaps 56 per cent. on an average. So that here is one point of advantage which we cannot afford to overlook, for not only does the ore contain more iron, but it contains less earthy matter; and that, I take it, is a point of very great importance in producing large quantities of material quickly, because we have so much less slag to get rid of, and therefore we need less fuel. Then with regard to the slag I find, as far as the composition of the slag is given, that there is very little difference between the composition of ours in Cumberland and what we have here; but as I have just said, with regard to the quantity we are at a disadvantage, having to produce considerably more slag—to melt and take away very much more slag than they have at the Lucy Furnace. So that this is one point where they have a gain.

With regard to the composition of the gas I find that it is practically the same as we have in England at most of our furnaces, so that this is no point of advantage.

With regard to the temperature of the blast we are told it is 1100° F. In fact that is about the temperature which we regularly get at our own works, so that in this there is no point of advantage.

With regard to the pressure of the blast, however, there is certainly a very important point of advantage. We are blowing at West Cumberland, and have been for many years, with a pressure of blast at 6 pounds to the inch, but here you have from 9 to 10 pounds. This I take it is a very great advantage in getting large outputs.

Then with regard to the volume of the blast. It is quite evident that a very much larger volume of blast is being blown at these furnaces than we are accustomed to deal with in England, and I know it has been a common idea among our English iron masters, that by increasing the volume of the blast and driving faster we did not economize fuel. I will come to that point later. Clearly, as regards large outputs, our American friends have a decided advantage in the higher pressure of blast and in the greater volume of blast.

Then in regard to the radiation of heat from the furnace, I think it is quite clear that they have a very decided gain here, and I cannot help thinking that it is one of the points where the gain and saving of fuel is to be accounted for. It seems to me quite clear that a furnace which is producing as much iron with one furnace

as we are producing with four must radiate a very much less quantity of heat than we do with the four furnaces; and therefore there is a very distinct gain made, and probably more than we have been accustomed to allow.

Then with regard to the composition of the iron; we are told the iron is made low in silicon; a little over 1¼ per cent. Here again I believe there is a distinct advantage. Some years back I had the opportunity of proving this, because we were then able to get supplies of that wonderful material, the Campen Hill ore, which contained only about 5 per cent. of silicon. It was very porous and enabled us to drive our furnace faster, to have less slag and to get iron with less silicon. For several years I, myself, drove our furnaces with 1¼ per cent. of silicon, which we took direct to the Bessemer works. Unfortunately the Campen Hill ore is becoming very scarce, and we in Cumberland cannot continue the use of it, and we have had to fall back on our local ores, which are more siliceous, and are ores generally with much more silicon than we formerly got. But we generally found that in making a non-siliceous iron we got a saving of fuel. I think that might reasonably explain it. There again, I think, is one cause of this wonderful saving of fuel, that they are working with pig iron low in silicon; they do not use carbon to reduce the silicon, and they probably make an iron which really contains less carbon than our own. It is a point on which, unfortunately, the hands of us Englishmen are somewhat tied, because our engineers when they go into the works do like to see No. 1 pig with plenty of graphite in it. If they come across a pig of iron which is approaching at all to white, they immediately look very ascant at it, and they immediately wonder whether we are not making very bad steel. Therefore, to keep up the character of our steel we have had very often to go counter to our own ideas as to what would produce the best economy.

Then with regard to the rapid driving of the furnace, I think this point may be important, because by rapid driving you save at all points. But the difficulty that we experienced with rapid driving in England was that we got a greater consumption of fuel. I never could account for that. I have always been an advocate of rapid driving, but my difficulty was that I could not drive rapidly. The men would not be driven, the manager would not be driven and the furnace would not be driven, because we had not got the plant and could not get it; but I believe certainly that when you have the advantage of being able to drive the furnace rapidly you must necessarily drive it economically, and I am in favor myself of the practice which we have had put before us. I think myself that we must have a great economy by this rapid driving.

As regards the life of the furnace, I believe in a short life and a merry one. I find if we had only the saving of coke of 4 hundredweight to the ton, which is 25,000 a year on this particular furnace, surely that is enough money to reline the furnace two or three times over. But I think the saving of coke is not the whole thing. I think there is a saving of wages as well. If you have to start and manage four furnaces, I think there must be many points—in fact, I am quite certain—where you will economize labor by getting the same result out of one. Therefore, I entirely agree with the work that is done here, and if I had to put up furnaces myself I would certainly rather put up one furnace to do the work than two, although two might produce the same output, and I would do it even if the two furnaces could be put up with the cost of the one.

After having considered all these points I yet fail to see where is the great point of advantage as regards either plant, material, the mode of working or the final result. I cannot help thinking that this result has been mainly due to this wonderful spirit of emulation among the proprietors, the managers and the men; and I for one would only be too glad if we Englishmen and our managers and our men can get contaminated with the same spirit. I should be very pleased to carry the spirit away with us.

JULIAN KENNEDY, OF PITTSBURGH,

called attention to the great effect produced by very small changes in the lines of the furnace. The furnace would not work at slower speed. Mr. Kennedy's remarks were as follows:

I have a very few thoughts suggested to me by Mr. Gayley's paper. The first one is the great effect produced by very small or apparently very small changes in the lines of the furnace. In our original work, when we started out on this fast driving of furnaces, when the work was not really as good as it is now, but when we tried just as hard to get it so, our fast driving was not altogether due to the desire to drive fast. We very often tried a little slower driving, but found that the furnace would not work at the slower speed, and we were therefore forced to drive as we did. I ascribe a great deal of this to the difference in the lines of the furnace from what they are now. These differences were not very large, but they still had some effect. As you noticed in Mr. Gayley's paper, he found on one furnace, when he tried to reduce the blast, that he came to a certain point, and then he could go no lower; and then by making a very trifling change on the top of the furnace, he found he could by degrees reduce his blast 3000 cubic feet. I think all through the paper we see evidences of the great effect of very small changes in the lines. When we first began this modern system of driving our theory was to use a wide top, and we carried that to the extreme, to our own detriment. Our theory was also that the proportion between bell and stock line should be geometrical instead of arithmetical. Assuming a 7-foot bell to be correct for a 10½-foot stock line, we assume a 12-foot bell would be correct for an 18-foot stock line, instead of 15. All through I think the record shows that the lines of the furnace have a great deal to do with the work.

I also think that Mr. Gayley's gas furnace was probably helped a great deal by his system of blowing. He is equipped with a very fine set of engines which are regulated by an automatic governor, which can be set at a certain number of revolutions and will keep that number of revolutions whether the blast pressure is 16 pounds or 6 pounds; and if you are around the engine house you will never know the difference.

With regard to the economical side of the question it seems Mr. Gayley has got his coke now to a place that is undoubtedly very satisfactory, and it is doubtful whether it will ever be brought much lower. The labor I suppose is as low as it could be in smaller furnaces aggregating the same production. The management in some departments must be less; the number of men is reduced; and if he succeeds in getting an average life of 300,000 tons to a lining, which I have no doubt that he will, if he gets a blast in which he is not compelled to stop by labor troubles or some other extraneous causes, I do not see why his practice economically will not be as good in every respect as it would be with a multitude of small furnaces aggregating the same production.

WILLIAM WHITWELL, OF ENGLAND,

describes what is being done at English works without much pressure, and with a furnace similar in lines to that shown in Fig. 8. The general methods followed at Thornby are mentioned, the quality of ore dwelt upon, and the consumption of coke. Furnaces not relined so often as here, and when necessary the work is more slowly done. Mr. Whitwell's remarks, in part, were as follows:

I rise at your call to say a few practical words on our practice at Thornby, in England. Nothing has been said during this discussion as to what is being done at the English works, so far as I have heard; and therefore I think it may perhaps interest some of our visitors to know what is being done without much pressure and with a furnace very similar in lines to the one that has been so highly approved by the several speakers—No. 8. We are working at Thornby a furnace 75 feet in hight and 18½ to 20 feet in diameter, with a bell of 10 feet 6 inches, and with a hearth of 10 feet, with six tuyeres. We do not use the large tuyeres so successful in America, because up to the present time we have not found it advantageous to do so. Our tuyeres are about 4½ and occasionally touch 5 inches when required. Our pressure of blast, on the other hand, does not exceed 5 pounds as a rule—the working pressure at the engine house; which practically at the tuyeres means 4½ pounds. We commenced many years ago with smaller furnaces, never more than 20 feet in diameter and 60 feet in hight. We were the first in the Cleveland district to use the rather larger cubical contents of furnace, and to some extent we were successful; but the additional hight in the Cleveland district was the great element of success. Our make is approximately from 700 to 800 tons per week. At the present time we are working in the fourth year of the furnace life, at about 800 tons; and we are improving, doing better, and we anticipate still further improvements. Our ores are very different from the rich ore that we have heard described so vividly here; and I should like very much to know, when the reader of this excellent paper comes to reply, whether he will tell us if the general American practice coincides in any degree with what we have heard described by him, or whether it is the particular individual furnace working this particular excellent ore from Lake Superior and ores of a similar kind. The ore that we use does not average over 50 to 50¼ per cent. It contains mixtures of various kinds. We generally use seven or eight different kinds of ores—ores from Africa, Elba, Spain—from North and South; and in mixing we try to arrive at the quality of pig that our customers require for the time being. We do not work so low in silicon as has been practiced here, and with such advantage too, but we make a pig for Bessemer purposes which runs from 3 to 3½ per cent.; and for the Siemens open hearth furnaces from 2½ to 3 per cent., and where customers require it we make it from ½ to 2 per cent. We try to keep our sulphur down. Our phosphorus generally runs a little below 0.04, and we sometimes get it down to 0.275.

Now as to our coke. Our average consumption will run for the last two years and is now running something like 1900 weight per ton of iron, with this 50 per cent. ore. The limestone that we use is the carboniferous limestone from our own district, and we use about 6½ to 6¼ hundredweight. In that respect we use very much less than is used here even for the richer ores; and I am very much inclined to think we might work more advantageously by keeping our furnaces more open and getting rid of our sulphur more successfully than we are doing if we would use more limestone. The average silicon in our ores is about 6¼ to 7 per cent.; and

if we get that and work with that regularly, we get very equable results. The ore comes in cargo after cargo, and in any works of that quality changes are to be reprehended and avoided. The best ores are the most economical to smelt.

In regard to the pressure of the blast, I am inclined to think we must suit ourselves in our driving and make it what is economical with us. If we want our furnaces to run on shorter time; if we are willing to lose something in the quantity of coke consumed—that is, to use rather more and drive harder; but if you can get your furnace to drive on a certain burden, I believe that is one point that we ought to look to. We are apt sometimes to put on pressure and drive our furnaces down. That simply means lowering the quality and rising in sulphur—two decidedly objectionable features which we always ought to struggle against.

One important point for our visitors to consider is this: We change our heats when our furnaces get too hot, rather than burn our iron. In America they never change their heats, I believe, in the best practice.

Again, we work by pressure. They work regularly, I believe, by the revolutions of the engine, and they always keep up the pressure and do not lessen the production of the furnace and keep up the quality that we do. In these two respects there is something to be learned. Now, how do they do? They have an individual engine always to one furnace, as a rule, in the best practice. They have not three or four engines working into the same main, and so contributing the common pressure to the one furnace, but they have an individual furnace, and feed it with the food most convenient for it, and if it can take more they give it. They do not check the pressure. If you could give us the same material—with our beautiful Durham coke, which runs from 5 to 7 per cent. hardly, the best of it—I believe we could show you different results; but, with the material we have, under existing circumstances, I think that our growth will have to be gradual. I should like, as I said before, very, very much, to know as to the point whether it is these individual furnaces, using 750,000 tons of the best ore and working the best, or whether those who are importing ores from Spain or Africa would get anything like an approximate result.

Now, what is our practice? Our practice is to make the most money, or in some instances to make the least loss; because it is not always profitable to make iron in England. And when we can keep the furnace a long time without checking it for repairs we think it is of advantage. As working now we expect to make something like 475 to 500 tons of pig iron from one lining in 12 years. If we do that we are perfectly willing to reline. We cannot reline as you do in America. Everything you do in America in the shape of repairs to building seems to be much more rapidly done than we have any experience of. I don't understand it. I hear of relining a furnace (and drying 14 days too) in seven weeks. We think if we reline it in three months we do exceedingly well. How you do it, whether your labor is more under command, whether your labor is more energetic, or whether there is competition in your labor, we do not understand. We are more limited in that respect. Of course we simply put our money in our furnaces, and perhaps we expect to build our two or three furnaces for the same amount that you spend on your one furnace. That is one point. You have great provision in heating power no doubt, but not so much as is given in our district. You have only three large stoves to one furnace with this large production, and therefore you do not work up perhaps to the same heat. These are points, as I said before, that I have not practiced. We shall go and see these furnaces throughout the district with intense interest, and we undoubtedly shall get all the information we possibly can and take it home and digest it. I believe the more we hear the better we shall be able to arrive at a conclusion as to what is the best for us to do under existing circumstances. In looking back over many years it has been interesting to us to see the enormous increase in production in America. We congratulate you heartily upon it.

A. E. HUNT, OF PITTSBURGH,

by the aid of a diagram, showed what may be termed the several stages in the growth of the furnace described. On the diagram were three lines representing the "average coke consumption," the "capacity in cubic feet of the furnace for one ton of iron production per day," and the "average daily output." The increased production followed a pretty uniform and steady law of rise. The coke consumption declined somewhat irregularly from 3000 pounds to 1920 pounds. Mr. Hunt then said in part:

The cubic feet capacity of the furnace for 1 ton of iron per day, beginning at 197 cubic feet, decreases very rapidly in that remarkable little Escanaba furnace (the furnace A, of the Edgar Thomson Works, which Mr. Gayley described), down to 90 cubic feet, then going to 135 cubic feet, and then decreasing steadily to 59 cubic feet, the present rate of capacity. And, as Mr. Cook told you yesterday, that low figure has been reduced even in the anthracite regions.

Those are the three results. We study the paper and the table to find what are the causes of the results, and in the table we have two columns in which we may find the causes—that is, we may or we may not. First, the cubical capacity of the furnaces; second, the volume of air blown into the furnace. The lower red line represents the cubical capacity, beginning at 15,000 feet (the little furnace, of course, goes outside of the diagram), and then goes down to 6000 feet. Then it comes up again to 17,000 feet, and then runs along very irregularly to the present 18,200 feet. The difference between the fourth furnace, and the tenth furnace in the list is nearly 400 cubic feet capacity, showing that the cubical capacity of the furnace is nearly a constant quantity. The volume of air is very irregular. I will ask any of the gentlemen to study this diagram and see if they can find any relation between the cubical capacity of the furnaces and the volume of air pumped into the furnaces, or a ratio between those two quantities, considering those two quantities as causes, and these other three lines as effects. I can find no such relation. If you say that rapid driving increases production and increases economy, then taking out certain figures I can show you also that the opposite causes will produce the same results. That rapid driving produces economy, and that slow driving produces economy; that large capacity gives economy, and that small capacity gives greater economy, and *vice versa* and in every other way that you can put it. So that the mere question of the volume of air pumped into the furnace, and of the cubical capacity of the furnace, is not the controlling cause in giving us low consumption of fuel and high production of pig iron. I do not pretend to say what the cause is. I think that it is very obscure, and one that might be studied.

I will say for Mr. Whitwell's benefit, in reply to the question whether this is an exceptional case which has been presented, that the Lake Superior ores are about one-half of the total ore consumption in this country, and that all the furnaces running on Lake Superior ores and Connellsville coke approximate very closely to this practice, wherever they are provided with proper equipment, engines, boilers and ovens; and, another thing, the Lake Superior ore and Connellsville coke, while it is a very important factor in the economy of production and in capacity of production, still is not the all important factor, because you will find in Tennessee and in Alabama, on much poorer ores and much poorer fuel, that very remarkably large yields are produced, although not equal to those yields.

Next followed

J. D. WEEKS, OF PITTSBURGH,

who said: Mr. Whitwell asked the question whether this practice was confined to the Lake Superior ores, and to this coke. I regret exceedingly that I have not with me a report of some practice at the Ivanhoe furnace in Virginia, which shows, on a small furnace and on ore giving a low percentage of metallic iron, with the Pocahontas flat top coke of Virginia, I think, as good results, all things considered, as are shown in Mr. Gayley's paper. The Ivanhoe furnace is a furnace only 12½ feet in the boshes, and it is only some 60 feet high. The ore mixture in the furnace yielded about 47 per cent. One portion of it was Pottsdam ore, and another portion was limestone ore, with very little lime in it, however. The ores were from limestone measures which had been washed, so that the stock went into the furnace washed. Considerable water came from the washing in connection with it. The Pocahontas flat top coke is a coke very low in ash, somewhere about 5 per cent., and it comes from a coal that has but a small amount of volatile matter in it, only some 18 per cent., I think, before it is coked. That small furnace, with 12½ feet bosh, has been run for the last six or eight weeks, producing about 68 tons of iron per day, on a fuel consumption with those ores of but little over 2000 pounds of coke to 2268 pounds of iron; and it seems to me that with the character of ore that we have there that that is an exceedingly good result. There is one thing more that I have hardly understood in this discussion. I have noticed that the only comparisons that have been made between that coke has been in the way of chemical characteristics. You have compared the Connellsville fuel with the Durham fuel simply by percentages of ash. Now, I think that I am right in saying that while the purity of fuel is one thing, the physical characteristic of coke, within certain limits at least, are of a great deal more importance than even the chemical constituents. I think that possibly in some of these physical characteristics the Pocohontas flat coke is not quite so good a coke, though lower in ash than the Connellsville coke. It does not have that coating of graphitic paint on it which seems to me is one of the most important things in connection with the working of blast furnaces with our cokes. It seems that that coating of graphitic paint, that we have seen in this country to be common, does not give us hot tops in our furnaces, and in absence of that silvery lustre, which nothing but a coating of graphitic paint, a fire proof coating, we do seem to have hot tops and greater fuel consumption than we ought to have with coke with even a lower percentage of ash, than we should have, or at least than we do now have, in the cokes which have a higher percentage of ash. I have been hoping that our friend, Sir Lowthian Bell, would tell us that it is in the coke—

where two cokes, one of inferior composition as to ash, that is with a higher ash, will give better results in a furnace than one with a lower ash in it.

SIR LOWTHIAN BELL

replied to this question as follows:

I should just like to say, in answer to the question which has been addressed to me with regard to the nature of coke, that the chemical composition affords no kind of solution to the question. Upon what it depends I cannot tell you, but this I know that different kinds of coke are more or less easily acted upon by hot carbonic acid. Now, in the event of that action going on in the upper part of the furnace (which, of course, is the only position at which it can take place) and the coke there is burned, burned by the carbonic acid, and instead of being a source of heat it is a loss of heat, you sacrifice, as I mentioned before, 5600 units for every unit of coke which you so treat. But, in addition to that, that coke, which ought to have been burned at the tuyeres never arrives there, and consequently you have that loss in addition. I have had many specimens of coke, brilliant and apparently of the highest quality, yet when I came to expose these to a current of carbonic acid, in a heated tube, they were more rapidly acted upon than other varieties of coke of a less inviting character. I take it for granted that the whole of that depends upon the mechanical character of the coke itself, and that the harder it is the more impervious it is to the action of which I have just spoken.

MR. MARTIN

said: I have had a little experience in this matter, and I may perhaps enlighten you somewhat. Some time ago, when I took the management at Dowlais, we were making coke on the ordinary ovens and without a very good system of washing. Since then that coke works with a very bad yield on the furnaces. In fact, it was put anywhere, and got rid of as fast as possible. The same fuel, thoroughly washed in a Coppee washing machine, and thoroughly coked in Coppee ovens, is now doing a work equal to the best South Wales coke made in the district; and, as far as the appearance goes, as far as lustrousness goes, the coke is not at all of an inviting character. I do not think that much depends upon whether the coke is lustrous or otherwise, provided it is hard and dense.

MR. GAYLEY

in conclusion said: The interest which has been manifested in the paper that I have presented is a matter of deep gratification to me; and I am sure that the discussion which has been entered into will be of much value to all of us. On account of the extent of the discussion I will make but a very few remarks. I will first allude to the shape of the furnaces. That is a matter that has been brought up in discussion. The shape of the furnace, as has been stated (and as I have understood from Mr. Richards that in the future advancement in America it will be in the construction of larger capacity, although our later experience at the Edgar Thomson Works has been just the reverse)—the drawings of these furnaces, as you see on wall, represent simple types of furnace. We had but six furnaces when these were first started to make comparisons with—from three to six—and now we have up to nine. The general practice has been to decide on one type of furnace, and then to carry that type through the whole line. Our more recent experience has been that we get a larger output and a lower fuel economy by narrowing our furnace stacks, as you will see by reference to the last furnace that I mentioned, where the cubical capacity has been reduced from 19,800 cubic feet to 18,200 cubic feet, with a larger output and a decrease in the consumption of coke. The tendency is, therefore, in the direction of narrow stacks; and I agree with the idea presented as to the angle of the bosh, as that which I have found in my practice to give the best results is 75°. Another point with regard to the quality of the ores. I do not know that we have any data showing the relative reduceability of the Lake Superior ore in comparison with the Cleveland ore, but that is a matter that we are now taking up, and I hope at some time in the near future to be able to present some results on that point. There is one point in particular in our practice with regard to ores that I wish to emphasize. We use at the Edgar Thomson Works probably 18 different kinds of ores and we have a great variety, as you see, to select from. Now, in a furnace making regular Bessemer iron, we aim to select from these piles of ores those certain kinds which we have demonstrated by actual practice to give better results when worked together; and our more recent practice shows that we are getting far better results by discarding the lump ore and using exclusively fine ore. And, by fine ore, I would also include those ores that come from Lake Superior which have a shaley structure. I would also emphasize the selection of coke. We endeavor, as far as possible, to get our coke from a mine where the quality is as uniform in appearance as possible, paying no attention to the chemical analysis, but selecting the hard and silvery coke and avoiding as much as possible the softer coke, which, as has been shown by Sir Lowthian Bell, is found to waste away at the top of the furnace.

So far we have followed, not the actual occurrences which took place at the meeting, but have concluded the discussion of Mr. Gayley's paper. This was done because of the value of the paper, and because it brought out, in the discussion, the wide difference between American and English practice. At the close of the discussion a most interesting event took place—namely, the presentation of the

Bessemer Gold Medal

to Hon. Abram S. Hewitt, who has done so much to advance the iron interests of the country, and who, therefore, deserves a recognition of this kind. Mr. Hewitt, in accepting the honor, imparted much valuable information in regard to the early history of the introduction of steel into this country. Sir James Kitson said:

I have now the duty—the very pleasant duty—to perform, of presenting to the Hon. Abram S. Hewitt the Bessemer gold medal for distinguished services to the iron and steel trade. When this matter was brought under consideration in London it was well known that, as Mr. Hewitt would be the first to acknowledge, there is more than one man in America upon whom we would gladly have conferred this distinction, and to whom this merit might be justly attributed, but Mr Hewitt has been known long to our distinguished members on the other side of the Atlantic as one of the most active minds in the investigation of new methods of manufacture, and one of the most enterprising metallurgists on this side of the Atlantic. Well, gentlemen, we proposed to Mr. Hewitt that he should receive this gold medal, but I think it is quite right, and is his due, that I should state that he at once declined to receive it; and he declined in a manner which rendered it impossible to any one but very persistent friends and very obstinate Englishmen to refuse. When we heard that our American friends had conferred once more upon Mr. Hewitt the distinction of president of the American Institute of Mining Engineers, and particularly with reference to our contemplated visit, and when we heard that he had been elected unanimously to that position, we felt that we had received the stamp of approval from this side. Gentlemen, as I said before, Mr. Hewitt has long been known to many of us in England as an advocate of scientific education; and a report which he made of the metallurgical products at the Paris Exposition in 1867 was one of the matters which drew very clearly and distinctly the attention of the English iron and steel trade to the necessity of further improvement in our technical education as to iron and steel; and it was one of those points which led ultimately to the foundation of the Iron and Steel Institute. The development of the ideas which he there investigated undoubtedly led our leading minds to the foundation of this institute; and therefore it is only a debt of gratitude which we are paying when we present to him this gold medal. But, gentlemen, his services to the iron and steel trade of America are very remarkable. If I might take up again the point which Mr. Carnegie gave me yesterday, that this is a year and that this is the country of "firsts," for, in 1856, very shortly after the announcement by Sir Henry Bessemer of his invention for the manufacture of steel at Cheltenham, Mr. Hewitt very quickly made his way across the Atlantic, and he made inquiries, and the result of those inquiries was that the first experimental Bessemer converter was erected at the works of Messrs. Cooper Hewitt & Co. in 1856. In fact, I believe that with the usual rapidity of Americans within 60 days from that announcement a Bessemer converter was working in the States. Of course it is to be understood that that was an experimental converter. It was not the establishment of the Bessemer process in the States. Well, then, I find further that Mr. Hewitt was the first to build an open hearth furnace in the United States. He was concerned with the Siemens patents, and his open hearth furnaces were worked successfully, and are still working successfully, and to him is therefore due the initiative of the introduction of that process. But not content with that, on the announcement of Mr. Snelus' invention for improved basic linings, Mr. Hewitt took an interest in that invention, which was the first step which led him to be associated with the Thomas-Gilchrist basic patents, and through his intervention that also was first introduced into the United States. I think, gentlemen, that I have given you a record which justifies our distinguishing him, and also ourselves, by enrolling him on the list of the recipients of the Bessemer medal. Of him as a man in New York it is not for me to speak. His integrity, his public spirit, his self-denial are all well known to you all. I think that I might rightly use toward him the words of one of your American writers, who says:

You know him well; no need of praise,
Or bonfire from the windy hill
To light to loftier paths and ways
The world-worn man we honor still.

I will now read to you the diploma:

Iron and Steel Institute, established in 1869, under the presidency of his Grace the Duke of Devonshire.

This is to certify that the Hon. Abram S. Hewitt, a member of the Institute, was by the unanimous votes of the president and council awarded the Bessemer Gold Medal for services rendered in the development of the iron trade of the United States.

MR. HEWITT

said in reply:

Mr. President and Gentlemen: This is the country ordinarily in which men, especially in public life, are required to ex-

press their sentiments on very short notice, and without preparation. I am sure that my fellow countrymen will make allowance for me if on this occasion I have reduced what I have to say to writing. If I were to trust to the impulses of my heart, and to the rather overpowering feelings which arise in listening to the words of Sir James Kitson, I should scarcely do justice to the dignity of the occasion, or to the society which I represent, or to the country in which I live. Allow me, therefore, for once to read what I have to say.

Mr. President: No one can be more sensible than I am of the great honor conferred by the bestowal of the Bessemer medal, or more grateful for the felicitous and generous words in which you have given expression to the decision of the council. Nevertheless, I am not able to accept this distinction, the great object of ambition in our profession, without a feeling of compunction, which justifies me in referring to the fact that when the decision was made known to me, I asked the council to reconsider its determination, and confer the honor upon some one who had contributed directly to the improvement of the processes which have brought the production of steel to its present state of perfection in this country. My own connection with the business, although lifelong, has been rather in the direction of administration and of the study of the economic conditions of the trade and of legislation affecting its interests than with technical details. I can make no pretensions to either scientific or practical knowledge which ordinarily constitutes the merit of the eminent men whom you have heretofore decorated with the Bessemer medal Nevertheless, I am somewhat reconciled to your decision by the information that this particular medal is conferred out of the ordinary course, and has been provided by Sir Henry Bessemer, in view of your visit to this country, in order to enable you to make a recognition of the wonderful development of the steel industry which has taken place during the last decade in the United States. Receiving it as I do with a profound sense of the honor which its possession implies, I feel that I hold it in trust, as it were, for the able engineers who have had to deal with the new processes for the manufacture of steel, and of whom you have seen fit to select me as the representative.

In one respect, however, I may have been sufficiently in advance of my associates to attract your favorable consideration. Mr. Bessemer read his celebrated paper describing the process of producing steel without fuel at the Cheltenham meeting of the British Association for the Advancement of Science, in the summer of 1856. An imperfect report of this paper was published in the journals of the day, and attracted my notice. The theory announced seemed to be entirely sound, and the apparatus simple and effective. I gave orders at once, without further information than that derived from the published report, to erect an experimental vessel for the purpose of testing the possibility of producing steel direct from the blast furnace. In the same year in which the paper was read the experiment was tried at the furnace of Cooper, Hewitt & Co., at Phillipsburg, in New Jersey, and the result served to show beyond all doubt that the invention of Mr. Bessemer was one which could be successfully reduced to practice. The same difficulties, however, which confronted him, showed themselves in this humble experiment, and the further prosecution of the matter was deferred to a more convenient season. We all know the obstacles which Mr. Bessemer succeeded in overcoming, and the marvellous ingenuity and wide range of knowledge which he brought to bear in perfecting his process. To-day—not yet 35 years from the time the announcement was made—it may be said to have revolutionized the iron and steel trade of the world. The whole product of steel of all kinds made prior to his invention was insignificant. To-day the production has reached 10,500,000 tons, being at least one-third of the whole consumption of iron in the world. It is still rapidly advancing upon the domain occupied by the ordinary iron of commerce, and it is quite evident that the time is not far distant when this commodity will be regarded as a relic of the past, although in some special branches its use will survive, serving to remind us of processes which otherwise would have been consigned to history. I do not propose to enlarge upon the practical application of the Bessemer process to the manufacture of steel, but if you will bear with me I think it would be well to direct attention to the effects of this invention upon the economic, social and political condition of the world. A very few considerations will serve to show that the Bessemer invention takes its rank with the great events which have changed the face of society since the time of the middle ages. The invention of printing, the construction of the magnetic compass, the discovery of America, and the introduction of the steam engine are the only capital events in modern history which belong to the same category as the Bessemer process. They are all examples of the law of progress which evolves moral and social results from material development. The face of society has been transformed by these discoveries and inventions. It is inconceivable to us how the world even existed without the appliances of modern civilization, and it is quite certain that if we were deprived of the results of these inventions the greater portion of the human race would perish by starvation, and the remainder would relapse into barbarism. I know it is very high praise to class the invention of Bessemer with these great achievements, but I think a candid survey of the situation will lead to the conclusion that no one of them has been more potent in preparing the way for the higher civilization which awaits the coming century than the pneumatic process for the manufacture of steel. Its influence can now be traced, although the future results are still beyond the reach of the imagination.

Its principal characteristic is to be found in its cheapness. Steel is now produced at a cost less than that of common iron. This has led to an enormous extension in its use and to a great reduction in the cost of the machinery which carries on the operations of society. The effect has been most marked in three particulars: 1, the cost of construction railways has been so greatly reduced as to permit of their extension into sparsely inhabited regions, and the consequent occupation of distant territory otherwise beyond the reach of settlement. 2, the cost of transportation has been reduced to so low a point as to bring into the markets of the world crude products which formerly would not bear removal and were thus excluded from the exchanges of commerce. The practical result of these two causes has been to reduce the value of food products throughout the civilized world; and, inasmuch as cheap food is the basis of all industrial development and the necessary condition for the amelioration of humanity, the present generation has witnessed a general rise in the wages of labor, accompanied by a fall in the price of the food which it consumes. I think it would be a very modest estimate of the improvement in the condition of the working classes as a whole, to say that in the essential elements of comfort the working classes of our day are enabled to earn and to expend at least double the amount which was at their command in any previous age of the world. This result appears to me to be due very largely, if not altogether, to the economy in the agencies of production, made by the cheap steel of the Bessemer process and of the other inventions which have followed in its wake. These are material results, but they are accompanied with the slow but sure elevation of the great mass of society to a higher plane of intelligence and aspiration. No better evidence of this can be afforded than the association of workingmen together for the advancement of their mutual and social condition. Troublesome as the trade unions may have been, they indicate a step in advance which should be the subject of congratulation among all well wishers of the race. I see nothing but good to come out of the modern tendency to association, and I hold it to be one of the chief glories of Sir Henry Bessemer that he has contributed more than any other living man to that condition of industry which compels all who are engaged in its conduct to combine on a scale unknown before his time in the work of economic production and equitable distribution.

The first striking result in the cheapening in the cost of the production and transportation of food products was felt in Great Britain, which is now compelled to import at least two-thirds of its consumption. The competition of our Western wheat regions with the products of India in the English market altered the whole condition of agriculture in the British Isles. The profitable raising of wheat practically became impossible, and the farmers who had depended upon it could no longer pay the rents stipulated in their leases. A general reduction of rent, therefore, became necessary, which of course reduced the income of the landlords. The aristocracy of Great Britain is a survival of previous conditions, depending for its existence upon the ownership of the land and the revenue derived from it. Hence, a serious if not fatal blow at the domination of what may be termed the privileged class of Great Britain was struck, unintentionally doubtless, by the invention of Bessemer. We have not yet seen the final result of the competition it has introduced, but enough is apparent to show that the structure of the British Government will necessarily undergo very serious changes, all tending to the transfer of power from those who own the land to the commercial, manufacturing, and working classes of the people. I think it is doubtful whether any event in modern times of equal significance has occurred. Sir Henry Bessemer has certainly been the great apostle of democracy, and although he may be inclined to disavow the claim, history will record the fact that he has been the most potent factor in the reconstruction of the British Constitution upon the basis, soon to be reached, of universal suffrage.

Turning from Great Britain to this country, the effects of the Bessemer invention have been even more pronounced and striking. The cheapening in the cost of transportation enabled us to increase enormously the sales of food products in foreign markets. In accordance with the well known law of commerce, that a nation cannot sell without buying, our imports of foreign merchandise have been increased in a corresponding degree. Under our fiscal system, made necessary by the war of the Union, a revenue has been derived enabling us to reduce our national debt in 25 years from about $4,000,000,000 to less than $900,000,000 at the present time, notwithstanding the payment of a pension roll which now amounts to fully $120,000,000 per annum. We can trace, therefore, directly to the Bessemer invention the ability to reduce our national debt, and finally to pay off the outstanding bonds at maturity. This proposition

can easily be verified by examining the results of the operation of our railroads, by which it will appear that since 1870, when Bessemer rails began to be largely used, the rate of transportation has been reduced about two-thirds, and an eminent authority has recently stated that the difference in a single year would now amount to $1,000,000,000, a very large portion of which is directly traceable to the greater durability of the track, due to steel rails, and the capacity to haul increased loads, no only in the cars but in the train. I doubt whether it ever occurred to Sir Henry Bessemer to consider the effect of his invention in furnishing us the means of paying off our national debt, but it certainly ought to secure for him the gratitude of every American citizen, and I am glad to have the opportunity on this occasion to bring this obligation to the notice of my countrymen.

The third point to which I would call attention is the vast extension and new direction of commerce which has resulted from the construction of steel vessels. The size of these vessels has enormously increased, and the cost of operating them has been reduced in a corresponding degree, comparing very favorably with the reduction of cost upon land, which is about one-third of what it was ten years ago. The characteristic of modern commerce is in the rapidity with which exchanges are made, and in the fact that all portions of the habitable globe are quickly reached. The commercial world has been converted into a vast clearing house for the exchange of products. One country may sell more than it buys, or buy more than it sells to a particular country, but the difference is counterbalanced by a corresponding sale and purchase from some other country. The balances are not paid in money, but are passed to the credit of each country in the general settlement which takes place in the banking centers of the commercial world. Thus the function of the precious metals is reduced simply to the payment of final balances, which in the course of any one year are small in amount. The economy in exchange thus effected is largely due to the improvement in transportation made possible by the general use of steel, aided by the telegraph and particularly by the submarine cables which now reach every part of the civilized world. The interdependence of the human race has thus been increased, and the possibilities of hostile action by war diminished in a corresponding degree. The name of Bessemer will, therefore, be added to the honorable race of men who have succeeded in promoting the gospel of "Peace on earth, and good will towards men," which our Divine Master came on earth to teach and encourage.

I have some hesitation, in conclusion, in referring to another point which seems to me to be required in order to complete this hasty reference to the claims of Sir Henry Bessemer to the admiration and gratitude of mankind. It is to be hoped that out of the stupendous results of his genius he has acquired for himself an ample fortune. How large the amount may be I have no means of knowing, but if he should be in the receipt of even a small percentage of the annual saving to society he would have the largest income of any man in the world. It is the fashion of the day to rail at the possessors of large fortunes, and there are people who imagine that they have been wronged by the existence of such aggregations of wealth. It is doubtful whether in proportion to the total wealth of mankind the portion which may be controlled by the few who are recognized as great capitalists is as large as in other ages of the world. But even if the case were otherwise no man can allege that he is not a positive gainer by the results of the Bessemer invention or that he suffers loss or damage in any way from the fact that Bessemer has secured for himself a small portion of the benefits which his genius has conferred upon mankind. His example is of inestimable value, therefore, in showing that the existence of large fortunes as a rule is the evidence of benefactions vastly greater to the wealth of the world by which all have gained and none have lost. Although there are undoubtedly striking exceptions to this general rule in the possession of fortunes due to accident or even to fraud, these exceptions only serve to call public attention to the real question which underlies the accumulation of wealth in private hands—namely, the mode in which it is used by their possessors. A great capital is a great blessing if it is employed in adding to the resources and advancing the civilization of the world. It is a curse only when it is used for demoralizing expenditures and vicious indulgence. The career of Bessemer, therefore, is admirable, not only in having added to the general wealth, but in the employment of his share of the proceeds of his invention for the spread of knowledge, the progress of industry and the reward of efforts to promote the welfare of the race. He is now in the evening of his days, but he is also at the summit of his fame, for he has lived to see the marvelous fruits of his genius in the advancement of his fellow-men to a higher plane of comfort and intelligence than has been possible in any previous age.

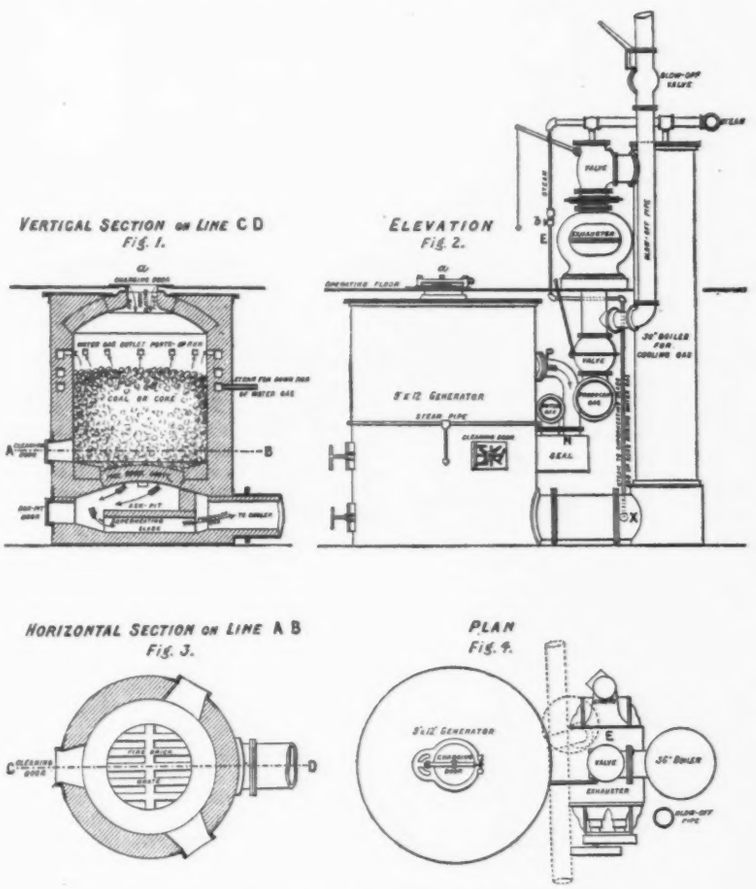
I think, therefore, Mr. President, that I am justified in asking you to carry back to Sir Henry Bessemer the grateful regards of his kin beyond the sea, whose homes he has multiplied, whose country he has developed, whose burdens of debt he has lightened, and whose progress in all the arts of civilization he has placed upon a basis as durable as the material with which his name will ever be associated.

The following paper was presented by Burdett Loomis, Hartford, Conn.

Fuel Gas and Some of Its Applications.

The discovery and application of natural gas has not only borne the weightiest of testimony on behalf of the general necessity for fuel gas in nearly all fields, but it has done more. Its wide scope of service, from the great establishments wherein thousands use it constantly, to the cottage where it saves countless steps for the housewife, has demonstrated the necessity for a gas of general application that will fulfil all the demands of the manufacturer and meet the wants of the domestic user. The fuel gas that is to score a wide success must fill these conditions. For a gas that will not the field is limited.

In the manufacture of a fuel gas, then, it is obvious that certain conditions are primarily necessary.



Loomis Gas Generating Plant.

As concerns the apparatus to be used, these are:

1. *Simplicity.*—It must be easily and cheaply worked, and require a minimum of skilled labor.

2. *Durability.*—It must do its work with but little repair or replacement.

As to the material to be used in the manufacture of the gas, the conditions are:

1. *Richness.*—It must contain the necessary carbon.

2. *Cheapness.*—It must be generally obtainable in large quantities at low prices.

These qualifications are met by the slack or fine bituminous coal, which are the least expensive of all coals, and are obtainable in nearly all markets at low rates.

These points established, it remains to decide upon the kind of gas to be made. This must be calculated to meet all the wants of those for whose uses it is intended. Here we find it necessary to consider the following:

1. *Quality.*—The gas must contain all the carbon possible, consistent with the other necessary conditions.

2. *Cost.*—It must be low in cost, especially in view of its use in large quantities.

3. *Cleanliness.*—It must be as free as practicable from impurities, and must be clean as regards the more perceptible.

4. *Transmission.*—It must be capable of easy carriage to reasonably long distances, and through small, as well as large, pipes.

5. *Temperature.*—It must have a constant high flame temperature, and must ignite under all conditions when desired.

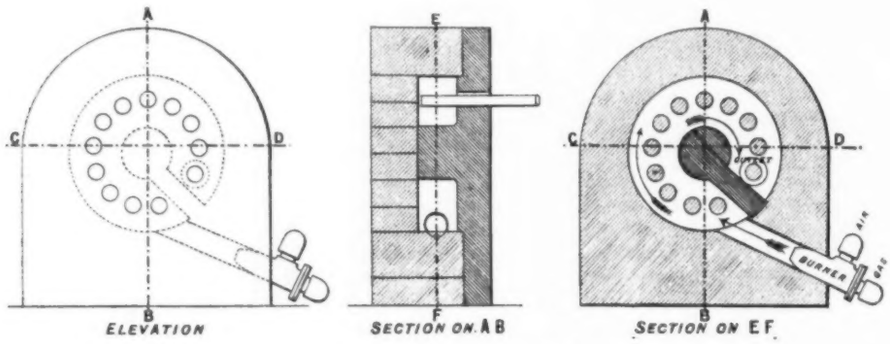
For general adaptability to the wants of all classes of consumers, the requirements named must be met, and the more completely met, the greater will be the success of the gas offered.

to acknowledgment of its claims. Can it be made from the cheapest of materials offered in the general market for gas making purposes? In discussing the lions in the path of success in this direction, the London *Journal of Gas Lighting*, some months ago, pronounced the following ultimatum:

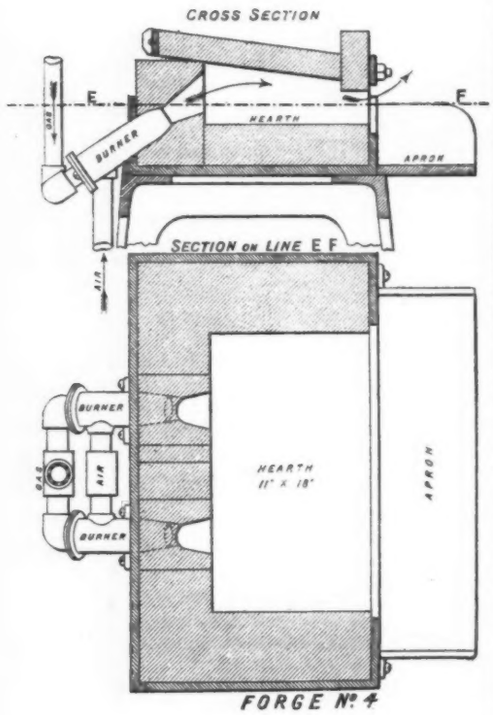
The slack, however wet, dirty, dusty, sulphurous or stony, should be tipped into the hoppers of the gas making cupolas, and gasification should go on continuously and completely, so that nothing but gas and ashes should remain of the material put into the apparatus.

This can be done, and is done, in many places, with the Loomis apparatus, which is using the cheap coals mentioned, as

The claim has been made that the water gas that can be made from a given amount of coal must be less economical than the coal used directly, both on account of the smaller number of units of heat contained in the gas and the labor and expense of making. Where coal can be well fired and gases economically burned direct from the furnace this is in many instances true, but the great fields for water gas lie in the special uses for the many kinds of metallurgical work and kindred work where coal directly used cannot enter as a comparative factor, and for domestic purposes, where the gas is proving itself as cheap as the coal, if not cheaper, while it accomplishes results that are not obtainable with the solid fuel.



Circular Flame Tip Heating Rod Forge.



In many cases a good producer-gas accomplishes all that is needed, and, used in a well constructed regenerative furnace, is much cheaper than coal; but its usefulness is confined to places where such furnaces can be constructed, if high flame temperature is required, or where low heats are sufficient and obtained without regeneration. Outside of such confines it is not economical and is seldom useful.

Without discoursing on the relative merits of other gases, I believe that the gas best suited for general fuel purposes is water gas. Its flame temperature is high, it is cleanly, reasonably free from impurities, and it can be transmitted to long distances.

The one possible factor to which objection might be made is its cost. If it meets this requirement, there is no further bar

well as the more expensive anthracite coals and coke. This apparatus is the only one that I know of in successful operation making water gas directly from the bituminous slack coals that are found in abundance in many parts of the world. It is a simple fuel gas generating machine, and it will not only make as much water gas from 1 ton of this slack coal as can be produced by any other method from the same quantity of anthracite or coke, but it also utilizes the blast gases for making the steam necessary to run the engines and exhausters, and for decomposing, leaving a surplus for other work; or the blast producer gas or generator gas can be used in regenerative, reheating, melting furnaces, &c. For these purposes the producer gas made by this apparatus answers all requirements, as can be shown by demonstration in the several places where it is so used.

Water gas generators, to be economical producers of gas, must be so constructed that they will continuously make a first-class quality of gas for the full period of a 24 hours' run. In all the generators using the up blast system, after a few hours' run the quality of the gas has become much poorer than at the beginning, when the fires were fresh, on account of the clinkers and ashes that accumulate.

In the Loomis generator this is obviated, and the gas is of as good quality at the end of a 24 hours' run as at the beginning or any part of the run. This is due to the peculiar construction of the generator and the action of the exhauster in collecting the ashes at the bottom of the fire and in the ash pit. In the process of exhausting before making a run of water gas, this is highly heated and useful for superheating the steam before it strikes the incandescent coal, and in this way the carbon is nearly all extracted from the coal, less clinker is made, the gas is freer from carbonic acid and increased production is obtained.

In the matter of quality a high grade of product should be aimed at, and the water gas made as pure as possible, so that it can be used, where practicable, without purification. In works where it must be purified the better the quality of the gas the less the expense for purifying.

In estimating the economy of its general uses another factor must be considered. This is application. In this particular the threshold of investigation has scarcely been crossed, yet much has been accomplished, while the future is fruitful of certain realization. Until lately the gas has not been obtainable for the purposes of experimenting in large quantities, and as yet, in special work, the methods of application are comparatively crude. Within the past few years, however, much has been done in the face of untoward circumstances, and you can now be shown the gas in use in many ways where it has supplanted coal, and wherein it has been found more economical than to fire coal, without taking into consideration any other features of advantage.

In nearly all branches of metallurgical work wherein the gas can be applied, however, there is found:

1. An increased product.
2. A better grade of product.
3. Direct economy in cost.

Increase in amount of product arises from the saving in direct labor, as can be most easily seen, perhaps, in forge shops and the like, and from the gain in the personal condition of the workmen, owing to the increased healthfulness of their surroundings.

The gain in grade of product arises chiefly from the uniformity in the temperature and the quality of the fuel.

The economy in cost needs no explanation. I may state, however, that in some large works which have changed from coal to the use of fuel gas the gain in direct economy has been proven to be from 33⅓ to 50 per cent. in labor and over 40 per cent. in fuel.

In many instances the gain from having a sharp, quickly heating flame is such as to overbalance the question of more direct saving in cost of production, and it is not infrequently demonstrated that, by this means, workshop material enough is saved to alone pay all the productive cost of the gas.

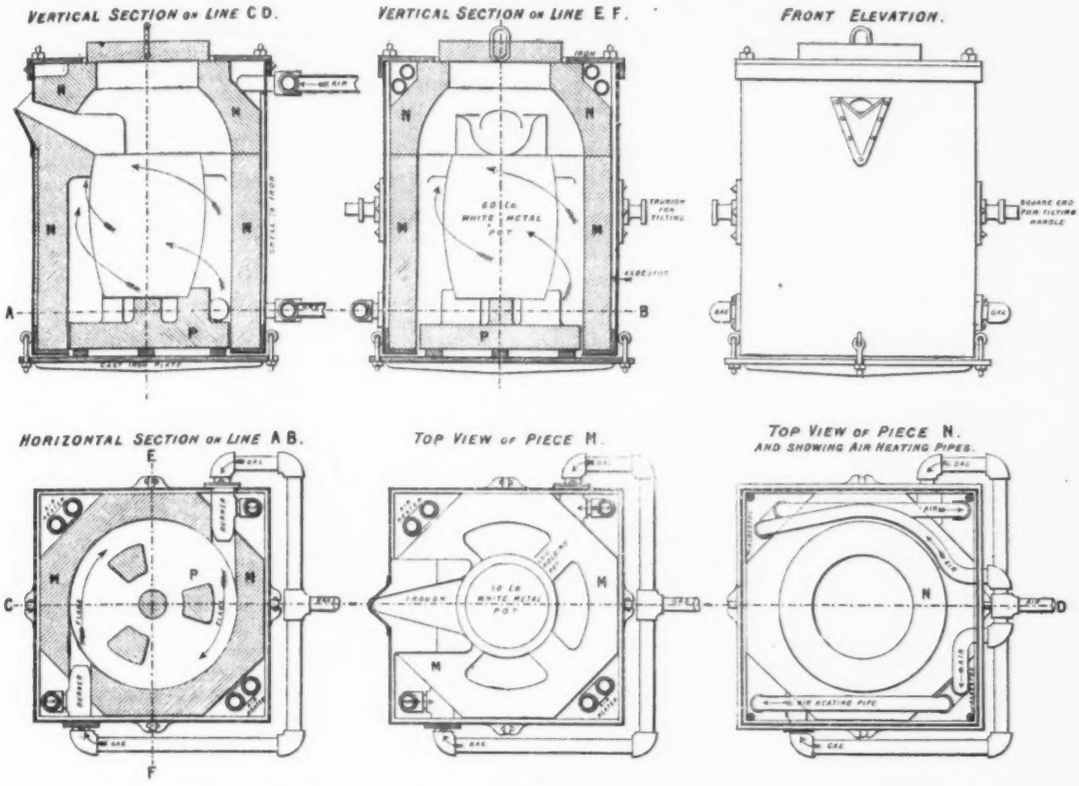
Another feature worthy of consideration is economy of space in locating furnaces or other appliances for the use of the gas, especially where it is desirable that these should be grouped together as closely as

possible. It also renders possible the location of furnaces, heaters, forges, &c., just where desired, without necessity for considering the questions of convenience that frequently arise where there must be either coal carriage or storage.

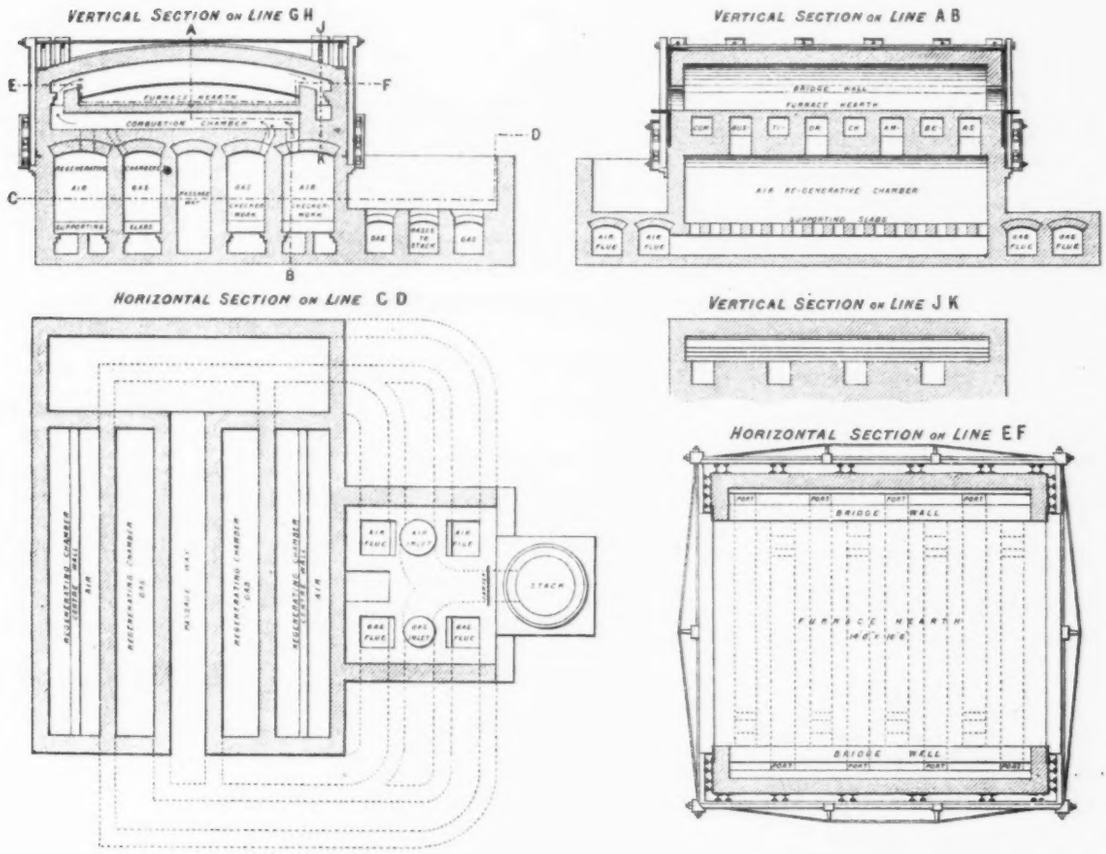
With this, too, may be considered the fact that the heat from the gas is brought under closer control than that from the coal fires, and there is less heat generated into the room or space surrounding the point of application. This perhaps may seem of minor importance, but in these days of sanitary investigation and of shortening the days of labor it will be found no little advantage to keep the temperature of the workroom as far as possible under control.

In many parts of the world inventors are devising new applications of this gas, and with marked success. It is so well made and so easily handled that it application in many new channels amounts to little more than ordinary manipulation and direction by those who understand the work to be done.

Among the several places in this coun-



Spiral Flame Tilting Pot Furnace with Hot Air Blast, Using Water Gas.



Furnace for Re-heating Steel Plates, Using Regenerated Producer Gas.

try where the gas made by the process I have named has been applied to such a variety of uses as plainly shows its adaptability as a general fuel, as regards both efficiency and cost, are the saw works of Henry Disston & Sons, which you will be invited to examine on your journey from New York to Philadelphia. There you will see the generators at work on steady and continued runs, and will see the two gases, *i. e.*—the water gas, and the producer gas that is made intermittently with the water gas—both carried to holders, and delivered under pressure at different parts of the works.

This is the first place of which I have knowledge where producer gas has been stored in a holder, and thence delivered cold to different furnaces at distances from the generators, being fired cold at such distant points. The process of manufacture and the manifold utilization of the different gases, but especially of the water gas, will be of interest. Full facilities for a thorough examination of the process of manufacture will be given, as well as full liberty to make any tests or experiments desired.

Estimated Cost of 1,000,000 *feet of Water Ga Based on Actual Results, Coal at* $3 *per Ton.*

Coal, 25 tons, $3 per ton	$75.00
Coal for steam, 3 tons, $3 per ton	9.00
Labor	22.00
Extra for supplies and repairs	4.00
Purifying	5.00
Total	$115.00
Received for producer gas	40.00
	$75.00
Interest on plant and depreciation	25.00
Total	$100.00

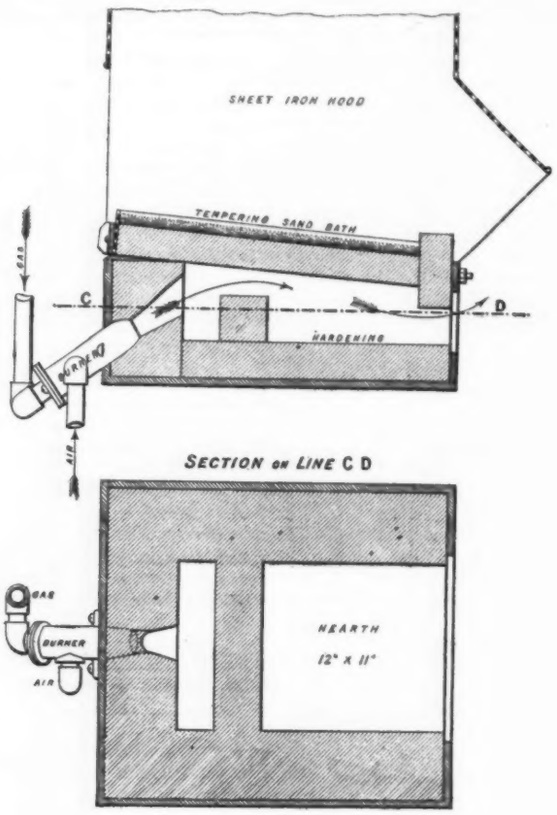
Cost per 1000 feet, $0.10.

In the practical using of water gas, 20,000 feet often accomplishes better results than a ton of coal directly fired; in some cases more is used.

This has been accomplished by new and improved methods of application, and will be improved upon as necessity demands and appliances are perfected.

I may say, in conclusion, that in no place where this gas has been put into use has any thought been given to a return to coal. The solid fuel, once supplanted, will never be sought for again.

Figures 1 to 4 show the way in which producer gas and water gas are made alternately.



Tempering Furnaces, Using Water Gas.

In bringing the coal to an incandescent state for making water gas, the door A is opened and the exhauster E is started and draws the air down through the coal and ash pit and up through the cooling boiler, and the producer gas made by this operation is forced through the pipe C to the holder.

When the coal is in a proper state for decomposition of steam the exhauster is stopped and the door A shut, and steam is let on at the valve B at point X, and it passes through the ash pit and grates, where it is highly superheated, then through the mass of coal, making water gas, which passes out at P through the seal box N to the water gas holder.

After a run of about five minutes the steam is shut off, the door opened, the exhauster started, and the process of making producer gas is again commenced.

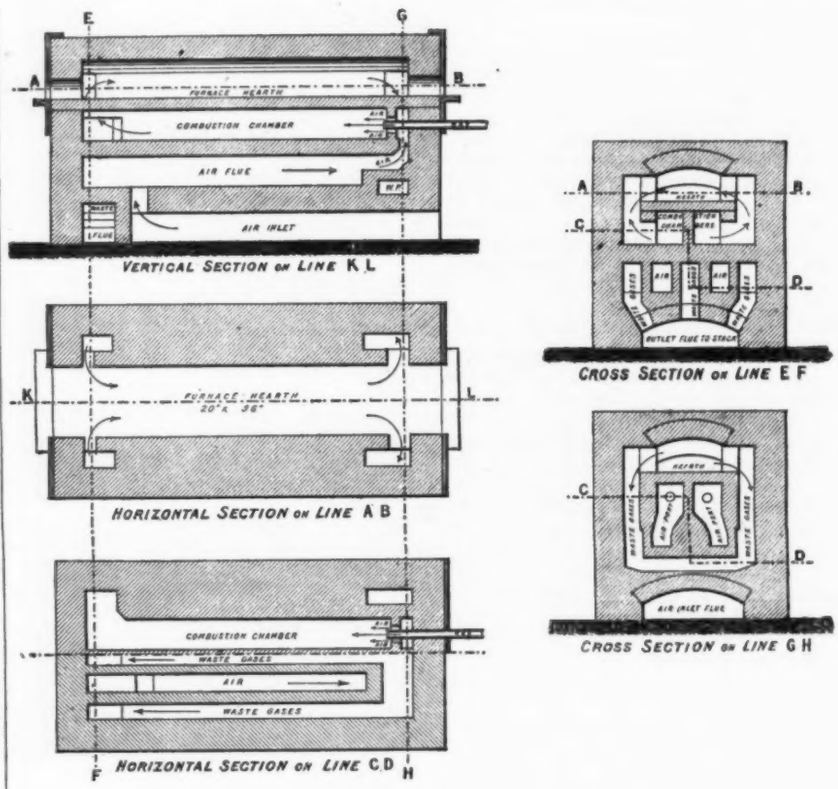
The other illustrations show the many applications of the process.

The next paper was by Prof. Henry M Howe, of Boston, on

Notes on the Bessemer Process.

The points mentioned in the following abstract are those which the paper deals with. The subjects are treated exhaustively from the practical standpoint.

The striking features of American Bessemer practice are its large output and its low initial silicon and initial temperature. These are interdependent. Large output implies short blows and short intervals between blows. Short blows imply low silicon and fast blowing. Low silicon implies short intervals and fast blowing. Our blows are short because we have little silicon to remove, and because we remove it fast by supplying blast rapidly. We get enought heat even with little silicon, because our blows and the intervals between them are so short that relatively little heat escapes from our vessels. Were we to lengthen our intervals, or to blow more slowly, we would have to meet the increased loss of heat from our vessels, either by using more silicon or by melting hotter—*i. e.*, by burning more coke in the blast furnace or in the cupola. Finally, our short intervals imply powerful machinery, efficient organization and extreme specialization and subdivision of labor, which can be profitable only when the output is large.



Small Hot Blast Rod Furnace, Heated with Water Gas.

Discussion.

P. C. GILCHRIST said: To us Europeans the very low silicons which have been given in the paper are extremely interesting. As far as I am aware, with the exception of Sweden, we are not able to produce steel successfully if we use silicon so low as 0.6 to 0.9. I do not think any of us could make steel, except Sweden, from pigs of that description and get it into the ladle, much less into the ingot; but I suppose that it is done. The very low silicon that they use explains at once why it is impossible for them to make, by their quick driving, a bad steel. If they can get the stuff into the ingots it would be utterly impossible to make it bad with ordinary care. As we all know, the only trouble in making acid steel is silicon. If you have high sillicon, you require great judgment in the matter of scraping or blowing in the steel so that it will regularly contain the same amount of sulphur. When you have only 0.6 to 0.9, you cannot leave any silicon in, and therefore, as I said just now, if you get it into your ingot mold (and that is the big *if*), it must be good; because you have only to add at the completion of the blowing a small amount of ferro or spiegel, which is a very simple thing, to give you a regular amount of carbon or manganese. So that to say that because they make it quickly they make bad steel, I think is absurd on its face.

The mixer that is described I think would be extremely useful to us in England. At one of the works that I am connected with we have tried to use pig iron direct from the blast furnace for the basic Bessemer, and we have given it up because, in spite of the regularity which blast furnacemen tell us they obtain, we do not find that we get pig iron direct from the furnace so regular as to give us the best results in the matter of yield and effectiveness.

The last point to which I would refer is the question of blowing in steel. I know that they have blown in steel, and it occurred to me that it is especially interesting to basic people and for this reason: As you are aware, in the basic treatment there is no after blow; you get rid of your phosphorus before the carbon is gone. In the basic Bessemer you always have the blow after the carbon is gone. If you could get rid of that after blow we should save from 3 to 4 per cent. in yield; and, although we make good material now we should make still better with no after blow. Therefore any man who discovers how to do away with the after blow will do one of the three things required to make the basic process perfect. It has always occurred to me that the reason that there is an after blow is that you are not able to give base to the material. In the basic open hearth furnace you give oxygen and you give hydrogen at the same moment, and you get rid of your phosphorus before your carbon. In the basic Bessemer you are not able to give a base before your carbon is gone. If some one will discover some vaporous or liquid base that he can blow in with the blast, then that person will do one of the three things required to make the basic process perfect.

The next paper was on

Aluminum Steel,

by R. A. Hadfield, of Sheffield, England. The paper first gives the early history of this valuable metal, describes the several processes of manufacturing it, and then deals with its alloys and the effect produced on steel and iron by the addition of small percentages. He showed that its presence does not materially increase the fluidity, did tend to give greater soundness of castings, diminished toughness, had little influence on hardness and destroyed weldability, at least so far as ordinary processes were concerned. The speaker continued:

Speaking generally of the application of aluminum to the manufacture of iron or steel, the usual amount stated to be requisite for producing good results is about 10 per cent.; but in many cases, as already pointed out, this would be too little. Supposing, however, that an average percentage of 10 per cent. or 15 per cent was necessary, and assuming the aluminum to be sold at 8 shillings per pound, the expense of such addition would mean an extra cost of 18 shillings and 27 shillings per ton respectively; whereas if as much as even 50 per cent. of silicon is required to do the same work, it does not cost more than 4 shillings 6 pence per ton. On a large output of steel castings this means a serious difference, and in the above nothing is credited to the latter method by the gain of adding so much ferro-alloy, which afterwards counts as steel.

In making these statements, the writer in no way wishes to disparage the efforts of those who have devoted so much time and attention to the production of aluminum. Let it be rather an inducement to produce the metal more cheaply. If aluminum can eventually be brought to compete in price with existing alloys, there is a probability of something being done in introducing its use on a larger scale. Aluminum may find a use for certain special purposes, such as in higher carbon steel, where silicon does not seem to act so powerfully in producing soundness as in the case of milder steel with carbon 50 per cent. and under.

Therefore, while for some special purposes aluminum may be employed in the manufacture of iron, at any rate with our present knowledge of the properties, this use cannot be large, especially when taking into consideration the fact of its comparatively high price. Its special advantage seems to the writer to be that it combines in itself the advantages of both silicon and manganese; but so long as alloys containing these metals are so cheap and aluminum so dear, its extensive use seems hardly probable.

The next paper was by Prof. Elihu Thomson, of Boston, on

Welding by Electricity,

who said, in part:

The operations with which this paper deals are those in which the heating effect of electric currents traversing a solid metal conductor gradually brings the metal to the working temperature. This temperature is, in the case of easily fusible metals, much below a red heat, and is hence unattended with luminous effects, which, however, appear in the case of metals softened or fused with greater difficulty.

In order to distinguish this process, applied to the welding of metals, from the application of the heating effect of an electric arc for like purposes, it has been called the incandescent method of electric welding—a designation which is, in my judgment, misleading, for the reason that lead, tin, zinc, and other metals, fusing far below the temperature of incandescence, are thus welded.

Electric welding occurs between pieces of all metals thus far tried, though the perfection of the joint obtained varies with the metals and with the conditions under which the work is performed. Many different metals unite each to the other, and in many cases the union is such as to possess a strength or tenacity equal to that of both, or of the weaker of the metals joined. In other cases it is not so strong, owing to wide differences in the physical nature of the metals or alloys, or in their tendencies to surface union. Perhaps the incipient alloying at the joint may affect the strength, according to the nature of the alloys possible to be thus formed.

The pieces to be united in electric welding may be in the form of bars of various cross sections, or in the form of tubes or pipes to be abutted and united, or in the form of plates. It is evident that a pipe is virtually a plate rolled up with its edges joined. The form of the pieces is of little moment, provided that they permit secure clamping for the passage of the current and manipulation. The surfaces to be united are first brought firmly into contact, the pieces being held in heavy conducting clamps for the purpose of carrying a current into them. The current having been put on heating of the metal between the clamps takes place to a degree which may be regulated at will, or may be automatically controlled. The pressing of the surfaces together unites them, if the joint be a butt joint, while a lateral or transverse pressure, such as that of hammer-hammering or pressing in dies, is used to make a lap-joint. The hammering or pressing is also useful with joints in iron or steel when butt welding is done, particularly where great strength is required, and the original section at the joint is to be preserved Such hammering or pressure may be applied simultaneously with the progress of the welding operation, or immediately thereafter, while the metal is still hot.

It is proper here to correct an impression which has gained some currency—namely, that it is the extra resistance caused by the break or limited contact between the meeting portions of metal which gives rise to the heating in electric welding. While this limitation of contact surface undoubtedly hastens the heating at the joint, it is nevertheless a fact that a solid bar, joining the clamps of an electric welding machine, will be heated between those clamps to welding temperature, and may be upset by the approach of the clamps one toward the other. Indeed, this process is actually employed to upset collars on shafts, or to set or fasten in place, by a sort of riveting action, collars which have been placed as rings, more or less closely fitting, upon a bar or shaft. The real cause of the concentration of the heating effect at the joint, or between the clamps, is the relatively greater conductivity of other portions of the welding circuit, which circuit is usually composed of massive copper conductors, kept cool, in the case of large work, by circulation of water. By thus keeping the clamps cool, as well as the conductor in which the welding currents are generated, their conductivity is preserved from running down and there follows a greater accentuation of heating effect at the joint, with the added result of a considerable saving in the electrical energy required to do the work. In the larger work it has also been found that hydraulic pressure may be advantageously employed, both for clamping and making contact with the pieces to be welded or worked and for pressing the pieces together in forming the joint. The pressure can be regulated in this case by a pressure governor to a constant amount for a piece of given size. A scale of pressures corresponding to certain sections and materials can be made beforehand, after which the operation may proceed without skill or knowledge on the part of the workman, whose duty is then confined to replacing pieces in the clamps and turning on the current of pre-determined force.

The apparatus first used by the author consisted of an alternating current dynamo, feeding a comparatively high potential current to the primary coil of an induction coil or transformer, the secondary of which was made so large in section, and so short in length, as to supply to the work

currents not exceeding two or three volts and of very large volume or rate of flow. The welding clamps were attached to the secondary terminals. This first type of apparatus has survived to the present day, and most of the apparatus is constructed on that principle, the secondary coil usually consisting of a single turn only. Other forms of apparatus, such as dynamos constructed to yield alternating currents direct from the armature to the welding clamps, are used to a limited extent. While currents of one direction are quite suitable for electric welding, no special apparatus has been constructed for using them. Currents from storage batteries are quite suitable for the purpose, but the batteries should be constructed to stand very great rapidity of discharge, otherwise they become very cumbersome and difficult of application.

In welding the ends of two bars, however, they are frequently rounded, and at the start meet only in the center. In such cases, whether the current be alternating or continuous, the heating effect begins at the center. A curious fact may here be mentioned. It is found that the distribution of the alternating current may easily be controlled by increase or decrease of self-induction at various parts of the section of the bar by the proximity of magnetizable iron masses. This principle has been applied in a variety of ways to govern the distribution of the heating-effect, and also to effect the restriction of current to the weld in thick rings. This will be adverted to later.

A glance at some of the typical actions and conditions found to exist in the welding of different metals may not be out of place. With metals such as lead, tin and zinc, the degree of heat required does not, of course, produce light, and the progress of the heating cannot be watched by the eye, as in the case of iron or steel. Therefore the plasticity, softening or fusion is really the index of the heat which the abutted ends have acquired. If the precaution be taken to shape properly the meeting ends of the sections before applying current and pressure, the joining of lead pipe sections, end to end, can easily be accomplished electrically, and the joints are very good and sound. The welding occurs best by an actual fusion of metal, a sort of autogenous soldering, or soldering of lead with lead. The meeting edges are best made beveled or tapered so as to expose a smaller section than that of the pipe or bar to the melting action of the current. On account of the poor conductivity, for heat and electricity, of lead and its alloys, comparatively large sections may be worked by moderate current strength as compared with copper.

The metal tin welds electrically with ease, as does also zinc, and even such brittle metals as antimony and bismuth present no difficulties. The welding of aluminum requires special precautions, but can readily be accomplished, and the joints, when properly made, are exceptionally strong and tough. In this case, recourse is generally had to the automatic welder, in which machine the conditions prior to putting on the current can be very accurately set.

The temperature resistance coefficient is, in general, much higher in the case of simple metals than in metallic alloys. The conductivity for heat has also a decided influence on the heating, and the comparatively low heat conduction of iron assists the work materially. Brass of ordinary composition scarcely seems to become plastic at all before melting. Hence the joints made with it generally show, in part, a real fusion and not merely a softening. In cases where the pressure used is too great, the joint is obtained by the crushing up of the hot metal in a semi-granular state before fusion, but this joint is not generally so perfect as the other. Some of the bronzes, and notably the alloy called aluminum bronze, show some plasticity before fusion.

The uniting of iron and various grades of steel is, of course, the most important industrial use of any welding process, and this is particularly true of an electrical one. The behavior of soft iron is particularly favorable to the welding operation. Its great plasticity before fusion renders its working and welding easy and simple. In the case of steel, for the higher grades of which, especially, the ordinary blacksmithing operation is liable to be very uncertain, the electric process is rendered easy and certain for all grades. When it is remembered that the exact conditions of current, conduction, and pressure at the joint may be made definite, and are perfectly under control, it is seen at once that, if the pieces are weldable at all, we can even establish an automatic control of the welding after these conditions have been once determined.

Electric welding machinery is now constructed in which these features are incorporated, and which is, at the same time, provided with appliances for shaping or hammering the joint, so as to preserve the diameter and increase the toughness of the metal thereat. Where the heat of the welding tends to change the structure or cause a tendency to granulate, hammering may be applied to retain the structure or to renew it during or after the union of the metal process.

There are many kinds of work to which electric welding seems to be peculiarly applicable. It is now in use largely for the joining of sections of wire into one length, and its use for such a purpose is still extending. Joints are regularly made in wires, which are afterward reduced in diameter by the wire-drawing process, various metals, such as copper, iron, brass, &c., being treated in this way. In other cases the electric welding process replaces the twisted joint formerly made in galvanized telegraph and similar wires—the galvanizing operation either preceding or succeeding the making of such joints. Even the ends of wire cables are readily jointed, the resulting weld possessing a strength not much inferior to the cable itself, and probably about equal to that of any heated or annealed portion. The making of such joints requires, of course, special precautions, but the operation is quite simple otherwise. In the welding and coiling of pipe the electric method seems to be especially expeditious and useful. Coils of pipe are now made continuously, as section after section of pipe is welded on. There is no limitation to the length of pipe which may be so welded and wound as one coil.

Somewhat akin to pipe welding is the making of armor-piercing shells (as devised by Mr. Wood) from sections of varied grades of steel and without screw joints. The sections are made separately, such as a head or point of high grade steel, a tubular middle section of softer, and a soft back piece perforated for loading; or the shell may be made of two sections only, jointed near the middle. These sections are placed in a welding apparatus of special and most interesting design, where they are welded together to complete the shell body, which is afterward finished outside. Experiments in firing shells made in this way have given satisfactory results, and further developments are being made as rapidly as possible. This, with much other work of like nature, is in the care of Lieutenant Wood. In the making of rings, links, bands, &c., the electric welding operation is particularly useful, and a number of machines specially designed for such work have been put into practical operation.

An important matter which may be mentioned in this connection is the facility with which the milder grades of steel may be manipulated in the welding by electricity. The advantage of the superior strength of the steel over puddled iron may thus be secured, which allows the use of a cheaper material, and less of it for a given strength. This remark applies forcibly to chain-making, in which the substitution of low steels for iron secures the double advantage mentioned, with the other advantages of the electric process over the ordinary ways of working. Considerable attention has therefore been given to the development of machinery for chain work, and a small working apparatus has even been made, which takes a wire from a reel and turns out lengths of chain with electrically welded links; the operation being automatic throughout. A curious feature of electric welding work is that two or more welds may be simultaneously made in parallel. This fact is utilized in chain making, where two welds, one at each side of a link, are made simultaneously. There are not yet in industrial operation any chain machines using the electric process. This step, however, is reserved for the near future. A special heavy chain machine will soon be completed.

In the comparisons between the strengths of electrically welded stock and the results of ordinary welding by the blacksmith, given in Sir F. Bramwell's paper, referred to above, the electric process has shown a somewhat higher percentage of strength, notwithstanding the fact that, in making up the averages, the specimens which broke outside the weld were, in the tests, counted out, and only those which broke in the weld were taken. If the specimens which broke elsewhere than in the weld are counted at 100 per cent. strength, the actual average strength obtained is between 95 and 100 per cent. In similar comparisons as to bending, it was found that the electric welds would not stand bending as well as the others, but when it was remembered that the electric welds were butt welds, and that in making them a comparatively very short section of the metal at each side of the joint was heated and annealed, while the ordinary welds were lap welds and involved the heating and softening of a considerable length of the bar, it was seen that the bending in the former case through a given angle will virtually be more than in the other case where more of the length takes part in the flexure. In such comparisons, as afterward pointed out by Sir F. Brambwell himself, each specimen should be softened by heat to an equal length and afterward bent under like conditions; otherwise no conclusion can be drawn from bending tests.

Again, the use of electric currents of large volume and low potential for locally heating metal to plasticity for shaping, swaging, rolling, spinning, or otherwise giving form to it, seems destined to be applied on a large scale in the future.

Among the operations which can be readily performed electrically is that of heating a rivet in place by current passed through it and heading it while hot. In numerous trials, it has been proved that short, straight sections may be used as rivets, and both heads formed simultaneously, either as projecting heads or as countersunk heads. The heating action may be so quick as actually to heat the rivet without communicating heat to the plates; or it may be slower, and the plates themselves may partake, in part, of the welding action, so that the rivet welds to the plates.

Considered in relation to automatic character, range of adaptability, the convenience and cleanly nature of the work, the perfect control of temperature secured, and the uniformity of result, the electric welding and metal working processes are decided advances over the prior art, and seem destined to a wide application. Al-

ready they have given rise to new methods of construction and have produced new articles of manufacture, and they will doubtless advance continually in this respect, in addition to their application to old constructions, or to the replacing of old processes in established manufactures.

A paper was read by C. B. Dudley, Ph.D., chemist of the Pennsylvania Railroad, Altoona, Pa., on the

Wear of Metal as Influenced by Its Chemical and Physical Properties.

In October, 1878, and again in February, 1881, I had the honor to make public, through the medium of the American Institute of Mining Engineers, the results of an extended study of steel rails which had been in service, and which were taken for the purpose from the tracks of the Pennsylvania Railroad Company. These studies appeared in three papers. In the first of these papers the question of what kind of steel is least liable to fracture or disintegration in the track was the principal one considered. In the second paper the question discussed was, Does the power of steel to resist wear increase with the hardness? In the third paper the relation between wear and the chemical and physical properties of the metal was the principal point considered. The general results arrived at, or the conclusions reached, were, as follows: 1, that a mild steel is less liable to fracture, and, if properly made, less liable to crushing or disintegration in the track than a harder steel; 2, that the wearing power of steel in rails not only does not increase as hardness increases, but, on the contrary, diminishes; or, in other words, that a mild steel gives less loss of metal under the same service than a hard steel.

My own criticism of this work, after the lapse of ten years, and after all the discussion which followed the publication of the papers above mentioned, may, perhaps, be fairly summed up in four conclusions:

1. If I had the work to do again I would certainly determine the sulphur in the rails, since all our studies during the past ten years on the influence of sulphur point strongly in the direction of indicating that the sulphur has an important influence on steel, especially in its effect on the carbon.

2. The influence of silicon, and especially its influence from the metallurgical standpoint, seems to be much better understood now than at the time when these studies were begun, and if an ideal formula, representing our views as to the best possible composition for steel rails, was to be made at the present time, the silicon limit would be raised somewhat, possibly to the favorite figure of Mr. Sandberg—namely, 0.10 per cent.

3. It is possible that in the first paper published the influence of the chemical composition on what is commonly known as crushing or disintegration of rails in the track was made more prominent than the facts would warrant. More mature or riper studies would seem to indicate that disintegration or crushing of steel is hardly a resultant of lack of soundness in the ingot, and is more mechanical than chemical, except in so far as chemistry may be responsible for the soundness of the ingot. If our views are correct, sound ingots, with consequently sound rails, can be made from steel of varying composition, provided time is allowed at the right points in the process, and the claim that high manganese and high carbon are essential to secure sound ingots is, in our judgment, not well founded, provided that time enough is allowed to make the steel properly.

4. In all our later studies on the wear of metal we have, as far as possible, avoided a method of deciding which metal is best which attempts to give what may be called absolute results. In other words, loss of metal by wear, per million tons, has some necessary errors in it, and, accordingly, in our later studies we have adopted the following method of comparison: Two metals of different composition are subjected as nearly as possible to the same wear, and the one which wears the faster, by comparison with the other, is regarded as the poorer, as will be explained a little later.

Otherwise than as regards the criticisms that the sulphur should have been determined, possibly the silicon limit raised a little, the influence of the method of manufacture on the final product made a little more prominent, and the comparative method used as far as possible in determining the difference between good and poor rails—we have seen little occasion to modify the conclusions stated in the papers as published—namely, that mild steel is not only safer for rails and for other constructive purposes, but also that mild steel gives better wear, or loses less metal under the same traffic, than harder steel. It seems quite probable that this conclusion will hardly be accepted by the mass of engineers, or by those who are engaged in metallurgical industry, and the object of this paper is simply to bring up to date the additional information which has been accumulated on this subject during the past ten years. Meanwhile, what light has the past ten years thrown on the special subject of the relation between wear and the chemical and physical properties of metal?

1. Since the papers above referred to were published no systematic study of steel rails has been attempted in the Pennsylvania Railroad Laboratory.

2. It will be remembered by those who are familiar with the discussion which followed the publication of the papers on steel rails, that some trial rails, according to the formula suggested in the first paper, were made in Germany, and inspected by Mr. Sandberg, who made his work the subject of a contribution to the discussion. The place where these rails went into service never came to my knowledge until a little over a year ago. At that time I received a letter from Mr. P. H. Conradson, the chemist of the New York and New England Railroad, stating that he had found in the records of that road that 2500 tons of steel rails, in accordance with the formula suggested in the first steel-rail paper above referred to, had been made at Gütehoffnungshütte, Germany, and had been laid on their road. Mr. Conradson's letter gave the formula on which the rails were ordered, which is practically the formula of my first steel-rail paper, and also states that the records show a number of reports of inspection, signed by Mr. Sandberg, with analyses made by Mr. Magnus Troilius. A number of analyses are also given, taken from the tests of inspection, showing, in general, that the rails came within the limits of the specifications—namely, in no case was carbon above 0.35 or below 0.25 per cent.; manganese was in no case above 0.40 or below 0.30 per cent.; phosphorus was between 0.055 and 0.075 per cent., and silicon varied from 0.01 to 0.08 per cent.; most of them being about 0.05 per cent. The physical tests were also fairly close to the assigned limits of the specifications—namely, they were generally within 75,000 pounds tensile strength per square inch, with not less than 20 per cent. elongation. the limits being from 73,000 to about 80,000 pounds tensile strength per square inch, and 17 to 23 per cent. elongation. The rails weighed 60 pounds per yard, and were put in the track where they could be subjected to the severest service. They remained at this point seven years, and were taken up to be replaced with a heavier rail. The words of the one most competent to judge, quoted by Mr. Conradson, are as follows: "These rails have not changed any during these seven years of continuous use so that it can be detected by the naked eye."

3. I am aware of the conclusions reached by M. Verschovsky, engineer in chief of the Russian State Railways, which were stated in a paper read before the Railway Congress in Paris in 1889. I have not seen the original paper, but simply a translation. Those who have read this paper know that the conclusions reached by M. Verschovsky seem to be directly opposite to the conclusions which we have reached—namely (if we can trust the translation which I have), "the best wearing rails have the greatest tensile strength with the least elongation;" and again, that the "rails which broke were softer, as far as indicated by tensile strength and elongation, and there is a difference between a hard rail and a brittle one." Still further, as regards the chemical composition, "the best rails contain more carbon and manganese than the brittle ones, and in all cases much more silicon and less phosphorus." In the absence of data as to what constituted the best rails—that is, as to how the best rails were decided on—and in the absence of any positive data of loss of metal by wear, it is, of course, exceedingly difficult to criticise or explain the conclusions obtained by M. Verschovsky. However, one point in the paper seems to throw some light on the possibilities of the case. It is stated that, in consequence of the specifications issued by the Government, the steel works did all in their power to produce a soft steel, so as to insure that the "frozen rails should stand the falling or drop test prescribed," and that this result was accomplished, but that, as a concomitant of this soft steel, a new difficulty appeared, which was that after a few months of wear the rails began to crush or flatten at the ends, so that in a short time replacement was found necessary. To our minds this seems to indicate that as the result of the effort of the steel works to produce soft steel, very unsound or porous ingots were obtained, which produced rails that were not sound and homogeneous, and which would be likely to behave exactly as M. Verschovsky describes. It will be remembered that this difficulty of getting sound ingots with soft steel was largely the burden of the discussion which followed the publication of the steel rail papers, and it seems fairly probable that the difficulty which M. Verschovsky describes may be entirely due to this cause. If the steel works, in trying to make the soft steel, so hurried the process that unsound and porous ingots were obtained, we see no difficulty in accounting for the conclusions which M. Verschovsky has reached.

Several years ago our attention was directed to the question of tires on locomotive driving wheels, which, as is well known, are made of steel. The question under discussion was the possibility of preparing specifications for locomotive tires, and, as a preliminary study, examination was made of a number of steel tires which had been in service. It may be stated here that for a number of years past the practical men in charge of the lathe shops on different portions of the Pennsylvania Railroad where tires are turned off noticed, and have stated in conversation, that they always had to turn off the most metal from the softest tire; that is to say, when the tires come into the shop for re-turning the very hard tires were the ones which had worn the most, the hardness being determined by the behavior of the tool during turning. This, of course, was simply an observa-

tion, and very little positive data could be drawn from it. A number of tires were taped as they came in from service to be re-turned, and in a short time three pairs of tires were found which showed marked differences in circumference. The circumference was measured by putting a tape around the tire. In one case the difference in circumference was 2 inches, and in each of the other cases the difference was 1¾ inches. This difference in circumference corresponds to a difference in diameter of from 0.55 to 0.63 inch, or from 0.27 to 0.31 inch in the thickness of the tire itself. In other words, by actual measurement of tires which had been in service on opposite ends of the same axle, which were of the same diameter and circumference when they went into service, in the case of two of the pairs, one of the two tires had lost a little over ¼ inch of its thickness more than the other, while in the other pairs one had lost nearly ⅛ inch more of its thickness than the other. In view of this discrepancy in wear under as nearly as possible the same conditions, it was with a good deal of interest that analyses were made of the metal taken from these tires. The results of the analyses are as follows:

Analyses of Unequally Worn Tires, from Opposite Ends of the Same Axles, on the Pennsylvania Railroad Locomotives.

	Least worn tire.	Most worn tire.
ENGINE 654.	Per cent.	Per cent.
Carbon	0.594	0.708
Manganese	1.076	0.938
Phosporus	0.039	0.101
Silicon	0.245	0.143
	Least worn tire.	Most worn tire.
ENGINE 136.	Per cent.	Per cent.
Carbon	0.541	0.625
Manganese	0.880	0.974
Phosphorus	0.062	0.063
Silicon	0.253	0.153
	Least worn tire.	Most worn tire.
ENGINE 626.	Per cent.	Per cent.
Carbon	0.525	0.554
Manganese	0.512	0.714
Phosphorus	0.032	0.037
Silicon	0.179	0.208

The tires of Engine 654 had a difference in circumference of 2 inches; the other two had a difference in circumference of 1¾ inches. It is interesting to observe that in every case the carbon is lowest in the least worn tire, indicating the softest steel, so far as carbon is concerned. Again, in two of the three the manganese is lowest in the least worn tire. In one of the three there is quite a difference in phosphorus, the lowest being characteristic of the least worn tire, the other two having very slight differences in phosphorus. In two the silicon is highest in the least worn tire, while in the other the difference is the other way.

5. Our studies on wear have not been confined wholly to the behavior of iron and steel under abrasion or rolling friction. A very large number of experiments have been made on the Pennsylvania Railroad with various alloys used as bearing metals.

The alloys experimented with have been principally the old copper tin alloy (seven parts copper to one of tin) and alloys of copper, tin and lead, with and without phosphorus and arsenic. It is not intended to say that no other alloys have been experimented with, but these are the alloys which have been most experimented with and in regard to which we have the most reliable data.

The standard bearing metal is what is known in the market as phosphor-bronze bearing metal, technically described by the Phosphor-Bronze Smelting Company as the "S Bearing Metal." This metal contains approximately 79.70 per cent. of copper, 10 per cent. of tin, 9.50 per cent. of lead, and about 0.80 per cent. of phosphorus. It is, of course, a fair question, and one which has not been overlooked, whether the standard bearing metal gives uniform wear. A large number of experiments have been made on this point, the result being that the average wear of standard phosphor-bronze, compared with the mileage, is best expressed by saying that the phosphor-bronze bearing metal loses 1 pound of metal, worn off, for every 18,000 to 24,000 miles of travel. The reasons for the discrepancy are not hard to find: First, the pressure per square inch in all tests were not the same, and consequently the wear would not be the same. On the other hand, with bearings on the opposite ends of the same axle, the pressures per square inch are approximately the same. Second, the state of the lubrication in different cars and engines, which is more or less characteristic of different parts of the road, is a very important variable, and undoubtedly goes far towards explaining the differences in mileage above given. We are inclined to think, therefore, that the assumption that standard phosphor-bronze is sufficiently uniform in its behavior to warrant its being used as the basis of comparison will not lead us into serious error, at least if we confine ourselves to a direct comparison of the loss of metal obtained from standard bearings on one end of the axles and experimental bearings on the other end of the same axles. The results of the tests, with the composition, and, so far as our knowledge goes, the physical properties of the various alloys tested, are given below.

COPPER-TIN VERSUS PHOSPHOR-BRONZE.

	Composition copper-tin. *Per Cent.*	*Composition phosphor-bronze.* *Per Cent.*
Copper	87.50	79.70
Tin	12.50	10.00
Lead	None.	9.50
Phosphorus	None.	0.80

Wear.—First experiment, cannon bronze wore 48 per cent. faster than phosphor-bronze; second experiment, cannon bronze wore 53 per cent. faster than phosphor-bronze; third experiment, cannon bronze wore 47 per cent. faster than phosphor-bronze.

ARSENIC BRONZE VERSUS PHOSPHOR-BRONZE.—FIRST EXPERIMENT.

	Composition arsenic bronze. *Per cent.*	*Composition phosphor-bronze.* *Per cent.*
Copper	89.20	79.70
Tin	10.00	10.00
Lead	None.	9.50
Phosphorus	None.	0.80
Arsenic	0.80	None.

Wear.—Arsenic bronze wore 42 per cent. faster than phosphor-bronze.

ARSENIC BRONZE VERSUS PHOSPHOR-BRONZE.—SECOND EXPERIMENT.

	Composition arsenic bronze. *Per cent.*	*Composition phosphor-bronze.* *Per cent.*
Copper	89.20	79.70
Tin	10.00	10.00
Lead	7.00	9.50
Phosphorus	None.	0.80
Arsenic	0.80	None.

Wear.—Arsenic bronze wore 15 per cent. faster than phosphor-bronze.

ARSENIC BRONZE VERSUS PHOSPHOR-BRONZE.—THIRD EXPERIMENT.

	Composition arsenic bronze. *Per cent.*	*Composition phosphor-bronze.* *Per cent.*
Copper	79.70	79.70
Tin	10.00	10.00
Lead	9.50	9.50
Phosphorus	None.	0.80
Arsenic	0.80	None.

Wear.—Arsenic bronze wore 1 per cent. faster than phosphor bronze.

DAMASCUS BRONZE VERSUS PHOSPHOR-BRONZE.

	Composition damascus bronze. *Per cent.*	*Composition phosphor-bronze.* *Per cent.*
Copper	77.00	79.70
Tin	10.50	10.00
Lead	12.50	9.50
Phosphorus	None.	0.80

Wear.—First experiment, damascus bronze wore 8 per cent. slower than phosphor-bronze; second experiment, damascus bronze wore 7.30 per cent. slower than phosphor-bronze.

	Composition Alloy "B." *Per cent.*	*Composition phosphor-bronze.* *Per cent.*
Copper	77.00	79.70
Tin	8.00	10.00
Lead	15.00	9.50
Phosphorus	None.	0.80

PHYSICAL PROPERTIES.

	Alloy "B."	*Phosphor-bronze.*
Tensile strength, per square inch, pounds	24,000	30,000
Elongation, per cent	11	6

Wear.—Experimental alloy "B" wore 13.50 cent. slower than phosphor-bronze.

If we interpret the above results correctly, they indicate: 1, that copper-tin wears nearly 50 per cent. faster than standard phosphor-bronze; 2, that arsenic bronze, containing no lead wears about 42 per cent. faster than phospor-bronze; 3, that arsenic bronze containing 7 per cent. of lead wears less rapidly, the exact figure being 15 per cent. faster than phosphor-bronze; 4, that arsenic bronze containing the same amount of lead as phosphor-bronze wears but slightly faster, the figure being 1 per cent.; 5, that damascus bronze containing as high as 12 50 per cent. of lead wears from 7 to 8 per cent. slower than phosphor-bronze; and, 6, that the experimental alloy "B," containing less tin and more lead than any of the other alloys experimented with (the figures being 8 per cent. of tin, and 15 per cent. of lead, instead of 10 per cent. of tin, and 9.50 per cent. of lead, as is characteristic of phosphor-bronze) wears 13.50 per cent. slower than phosphor-bronze. This last alloy is the only one of which we have the physical properties compared with phosphor-bronze, and it will be observed that it has considerably lower tensile strength with greater elongation than the phosphor bronze. This characteristic of lower tensile strength and greater elongation, it will be remembered, is the same characteristic which has been so often alluded to in the case of steel—namely, the mild steel, which, as is well known, is characterized by lower tensile strength and greater elongation than harder steel, gives the best wear. Here, too, in the realm of alloys, that metal which gives the lower tensile strength and greater elongation, if our experiments can be trusted, gives the slower wear; or, in other words, that in the realm of the alloys, so far as our experiments have gone, the same thing holds true which we have heretofore found in regard to steel—namely, the softer metal gives the better wear.

A few points further in regard to wear. We are not aware that any attempt has ever been made to formulate the variables on which wear depends; or, in other words, to enunciate a theory of wear, and it is entirely possible that the data in our hands, which are reliable enough to be so used, are not at all sufficient to warrant us in making such an attempt.

Of course, wear is influenced by the conditions under which it takes place, but it is not our purpose to discuss these variables which may fairly enough be called "concomitant conditions."

To our minds we are justified in assuming that at least three elements enter into the problem of wear.

1. That metal which will suffer the most distortion without rupture will wear best. This quality of metal is usually measured or expressed in figures by the well known physical data "elongation" or stretch before rupture in the common physical test. Possibly the experimental data on this point is greater than we possess on any other of the variables which enter into wear. If we may trust the data which we have brought forward, and

the conclusions drawn from them, in all cases the greatest elongation is characterized by the best wear; or, according to the law, that metal which is characterized by the greatest power to resist distortion without rupture will wear best.

2. The first variable being obtained in satisfactory amount an increase in tensile strength will add to the wearing power of the metal. The diminution of tensile strength, which is characterized by the better wearing metals, according to our data, is not, if we are correct, a desirable quality. It is a concomitant of most metal that as it increases in its power of elongation, or stretch, before rupture, it diminishes in tensile strength. If, on the other hand, a new metal could be found, which, with any given elongation, was characterized by a higher tensile strength than some old and well known metal with the same elongation, the new metal would, if the theory is correct, wear better than the old one. It is not difficult to say why an increase in tensile strength should be valuable in assisting wear, provided the power of distortion before rupture, is not interfered with. Wear, as we understand it, is the tearing off of minute particles, and if in one case it requires more force to tear off the particles than in another, the wear in that case will be slower. We have, we think, a little experimental data which points in this direction. The wear of bearings per thousand miles, is about three times as fast as the wear of axles; in other words, as has already been stated, the standard phosphor-bronze bearing metal, loses about a pound for each 25,000 miles that the bearing moves. The axle under it loses about a pound for each 75,000 miles, but the metal of the axle is from two to three times as strong per square inch, and its elongation is also somewhat higher than the bearing metal alloy.

The third variable which enters into wear, as we look at it, is what may perhaps be termed the "granular structure of the metal." This may, perhaps, best be illustrated by saying that, of two metals which have the same tensile strength and the same elongation, the one which is finer in granular structure will wear the slower. This we think will be evident by returning to our conception of what wear is—namely, the tearing off of minute particles from the worn body. If, now, at each rupture of a particle of metal, the particle torn off is in one case twice as large as in the other, the wear will be twice as rapid, and we assume that, other things being equal, the granular structure represents the size or fineness of the particles torn off at each operation during wear. We have only a little experimental data on this point.

The whole subject of the relation between wear and the chemical and physical properties of metal needs study and positive experiment, and it is quite possible that much that we are accustomed to rely on at the present moment may be upset or overthrown by wider knowledge. The best we can say at present is that, with the light which we have, the highest tensile strength, accompanied by the highest elongation and the finest granular structure, are the physical properties which will probably give the best results in actual service where the metal is subjected to wear, and that that chemistry which will give these results in the finished product, be it in the realm of the alloys, or in the magnificent field of steel metallurgy, or, possibly, in the coming field of a metallurgy based on aluminum, is the best chemistry which we, at the present moment, are able to recommend.

Discussion.

SIR LOWTHIAN BELL said: I have listened to this paper with very much interest. It happens that the president and myself are members of what, in our part of the world, is called Locomotive Committee of the North Eastern Railway, which is a railway of 1500 miles in length, and therefore affords ample scope for making an inquiry bearing upon the question now submitted to this meeting. In one point I entirely agree with Mr. Dudley, and that is in the difficulty of assigning a just cause for the differences which are observed in the wear of rails. I may mention that upon the North Eastern Railway we followed to a great extent the advice given to us by the manufacturers of the rails themselves. We were of the opinion that in all probability it would be found that the softer the rails were the stronger they were; and we continued to use rails not containing above 0.3 to 0.4 per cent. of carbon. Our engineer at that time (a gentleman of great experience and greatly respected for the use he has made of that experience), and myself and other members of the committee, frequently discussed the question as to whether we might not with advantage to the railway increase the quantity of carbon in the steel, with a view to increasing its hardness, and, as we expected, increase its resistance to wear upon the railway; and accordingly, at our advice, the board of directors consented that our rails should be raised from 0.3 and 0.4 to 0.5 per cent. of carbon. We have continued now for some years to have our rails guaranteed by the makers to contain that quantity of carbon. I cannot say that we have had sufficient experience to enable us to pronounce very strongly as to the benefit that we hoped to derive from that change; but this much I think I may say, that if there is any reason for a contrary line of conduct it has not up to this time made itself very apparent to ourselves. The question may seem a very simple one; it is one, however, which is replete with difficulty. There is very great difficulty in getting always the conditions to which the rails are exposed exactly the same in every case. Mr. Dudley mentions what the wear of rails had been during a certain number of years upon the New York and New England Railway. If we were to collect the statistics of our own line in that way we should have a variety of very discordant results, for the reason that not only has the traffic upon our line greatly increased, but (and perhaps what is of more consequence so far as the wear is concerned) we have greatly increased the weight of our locomotive engines; and in consequence the conditions, as I said before, no longer obtain upon the same footing as they were in former years. Having this in view I was anxious to establish a rapid mode of ascertaining the relative wear of rails having different compositions; and I directed the superintendent of our locomotive department to construct a machine in which, by the rapid revolution of a wearing surface—a kind of grindstone, in point of fact—we might in a few weeks compare the results of actual loss of weight of rails. Like most mechanical contrivances—at first, at all events—perfect success did not attend our investigations upon that footing. But I am not going to relinquish them on that account. I may say that I heard with very great surprise the statement of the amount of carbon contained in the locomotive tires. Mr. Hadfield, perhaps, can give us some information upon that subject, but so far as I know, we have no tires running upon the North Eastern Line of England in which the carbon is as high as 0.6 to 0.7 per cent.; and usually our locomotive tires contain very little more than half that quantity. That is, we reckon to run at about 0.45 and our wagon tires at about 0.35 per cent. of carbon; and I think if an analysis of the tires of that character were brought before my committee I should be somewhat alarmed as to the results which might flow from using so high a quantity of carbon as that mentioned by Dr. Dudley. However, it is perhaps premature to declare very strongly any opinion upon that subject until we have more experience than we have received up to this time. We keep a record (as no doubt they do upon the railways here) of the number of rails which are broken every 12 months. Our line, as I have mentioned, is about 1500 miles in length, and of that stretch I should say that something like 1400 miles are laid with steel rails, and whenever a rail is broken, or whenever a fracture takes place, the rail is brought into the chemical laboratory of the company, and an accurate analysis is made of its composition. I think on this point I agree entirely with Mr. Dudley, that all the chemical information we have got up to this time has entirely failed to throw light upon the cause of the fractures. I am inclined to think that it may be rather due to the occurrence of that critical condition or that critical point of the rail due to questions entirely different from that of chemical composition; and that either the rail has been cooled too suddenly or too slowly. At all events, in the way of chemistery we have not been able to trace a fracture to any chemical cause.

A paper was presented by Edmund C. Pechin of Roanoke, Va., on the

Iron Development and Ore Resources of Virginia.

The writer approaches this subject with a great deal of diffidence—first, because it is utterly impossible to satisfactorily treat it within the limits of a paper, and secondly, because the larger development is of so comparatively a recent date as to make authoritative data on some interesting points unavailable.

For over 100 years small charcoal furnaces have been in existence, at widely scattered points, making a few tons of iron daily, and then gradually increasing to a daily output of, say, 10 to 12 tons, as the market widened. With the exhaustion of local supplies of wood, inaccessibility to market, and sharp competition, bringing lower prices, many were compelled from time to time to make temporary stops, and finally to cease altogether. During the first half century there were at different times in operation between 75 and 90 charcoal furnaces. The last Directory of the Iron and Steel Works of the United States (1890) gives 19 as the number of charcoal stacks in Virginia. Of these several are cold, and, it is perfectly safe to say, will never resume. All of them lie within a few miles of the Norfolk and Western and Shenandoah Valley railroads and run on the brown ores of, and adjacent to, the Potsdam sandstones, to be hereafter described. The iron made by these furnaces was almost wholly cold blast and noted for its excellence for tough castings and chilling car wheel irons. The change came when the completion of the Chesapeake and Ohio Railway made the fine coking coals of West Virginia available, and an extraordinary impetus was given when, in 1882, the Norfolk and Western Railroad, with wise foresight, built to the Flat Top coking coals and opened up that wonderful field to the outside world.

The census year of 1880 gave the total output of pig iron in Virginia as 17,906 tons.

The census year of 1890, just completed, gives 302,447 tons. Of this, the charcoal production was under 18,000 tons, the balance being made by 12 coke furnaces. The rapid increase in late years is best seen by the figures of the annual production: 1886, 156,250 tons; 1887, 175,751 tons; 1888, 197,306 tons; 1889, 251,356

tons. There are now in course of active construction (and the majority nearing completion) ten large first-class modern coke furnaces, with a yearly capacity of 250,000 gross tons, and several projected.

The important question now arises: What are the sources of ore supply for all of these plants? To settle this it is necessary to briefly consider existing geological conditions.

Every known character of ore is to be found, in varying quantities, in the State of Virginia.

1. The magnetic, specular and gossan ores in the older rocks east of the Blue Ridge (Archæn belt).

2. The hydrated brown hematite of the Potsdam sandstones and slates and in the Silurian limestones overlying them (Nos. I and II of Professor Rogers).

3. The hydrated brown hematite of the Lower Silurian shales (No. III of Professor Rogers).

4. The anhydrous red hematites, or fossil ore, of Professor Rogers' Hudson Epoch No. V, ordinarily known as the Clinton or dyestone ores (Upper Silurian).

5. The hydrated brown hematites of the Oriskany Epoch of Professor Rogers, No. VII (Upper Silurian).

6. The hydrated brown ores accompanying the subcarboniferous limestones of No. XI.

7. The carbonates of the coal measures, No. XI.

These will be considered in the inverse order.

The carbonates can be dismissed without further notice. As yet they have only been found as nodules in the slates, and are of no commercial value whatever.

Of the subcarboniferous limesone, brown ores but little is known. They are of unusual occurrence, and apparently only local, and on a limited scale. As far as they have been identified, they occur along the line of the great fault in Tazewell County, Va., on the Clinch Valley extension of the Norfolk and Western Railroad, by which fault No. XI is brought into direct contact with No. II. The external indications for many miles would lead the casual observer to believe in the existence of very large bodies of ore, but positive developments weaken this impression. The quality of the ore is very fair, a considerable number of analyses showing:

Iron from 38 per cent. to 49 per cent,
Silica from 13 per cent. to 22 per cent.
Phosphate from 0.13 per cent. to 0.44 per cent.
Manganese from 1 per cent. to 2.40 per cent.

While these ores may serve as a local supply, they can never become, from present knowledge, of commercial value—in Virginia at least.

No. VII.—We now come to one of the great leading ore deposits of Virginia, which has during the last eight years furnished the largest amount of ore, and which was until within the last year the largest annual ore producer, but which is now being exceeded by the output of the ores of Nos. I and II. It is commonly and commercially known as the Oriskany brown ore, and supplies the furnaces at Lowmoor, Longdale, Victoria, and Princess.

At the present time these deposits are only reached by the Chesapeake and Ohio Railway. As there seems to be no reason for doubting the existence of the measures carrying these ores for several hundreds of miles through Virginia, in a Northeast and Southwest direction, it is quite within the range of probability that at no distant day the large area carrying these measures, now inaccessible, will be penetrated by new railroads or branches from existing roads, and the output of ore largely stimulated thereby. This is particularly probable from the fact that this ore deposit, in connection with that of No. V, hereafter noted, lies nearer to the great coal fields than any other. Incidentally it may be stated in passing that recent developments from Big Stone Gap, Wise County, Va., and Middlesborough, Ky., positively claim the existence of the Oriskany ore at or near those localities. This being the case, it seems to prove the continuity of this ore deposit over several hundreds of miles. The well known aphorism, "all is not gold that glitters," is thoroughly applicable not only to this great lead of ore, but to all other brown ores, to be hereafter considered. To quote from a recognized authority, the late Prof. J. L. Campbell, of Washington and Lee University, Lexington, Va.—"Although the Oriskany is the most important of the ore-bearing formations in this particular region, it must not be inferred that every part of it, or even the greater part of, is iron ore. Large portions consist of a coarse, gray sandstone, that is frequently highly colored with iron rust, and that breaks up rapidly when exposed, and weathers into round boulders of a brown color."

In many places gigantic boulders, and even cliffs, 20 to 30 feet high, outcrop on the mountain side, and strike the inexperienced observer as iron ore, pure and simple; but oftentimes these masses are fatally charged with silicious matter, and are commercially valueless. Yet these are usually the landmarks which indicate large and valuable deposits of good ore immediately under them. Great variations both in quantity and quality occur in close proximity, even in thoroughly good mining ground, requiring the watchful attention of the practiced eye and experienced miner. The usual pitch of the ore can be taken at about 45°, conforming to the general stratification, but this is constantly changing, at times flattening out, and at other times nearly vertical.

Originally worked in and near the outcrop, as open cuts, the large mining operations are now chiefly underground. The present mines at Longdale, Alleghany County, Va., give information of much value, and serve as an illustration. Originally supplying a charcoal furnace, requiring very limited supplies, open cuts were made at the outcrop, about 400 feet above the creek level, on the hillside. These ran as open cuts about 4000 feet in length, and about 100 feet in depth. At the outset these same workings supplied the coke furnaces, but at the depth of 100 feet it became impossible to keep up the walls, and underground mining was resorted to, and is now the only source of supply. In locating a tunnel, a shaft was started at the floor level of the open cut and sunk 200 feet, with a somewhat disappointing result, as the ore when struck was at that point only about 12 feet wide, and not of average quality. Notwithstanding, the tunnel was driven 1100 feet, and struck the ore at the depth of 200 feet, but about 150 feet north-east of the shaft. The ore at this point was 25 feet wide and fully up to the average. From here adits were driven along the ore 1400 feet south-westerly and 1900 feet north-easterly. Still lower down the valley another tunnel was driven, striking the ore 120 feet below the bottom of the shaft, giving thorough drainage to the whole mine. From the surface to this lower level the ground is opened up by adits and winzes, making a splendid piece of mining property. The ore holds throughout, but turns and bends, and stands at every angle, conforming to the interstratified rocks from almost vertical to nearly flat. The mine is worked so that in coming back the pillars are drawn, the roof allowed to fall and the hill completely robbed.

These details have been gone into because the conditions found here are likely to be characteristic of this ore lead throughout the whole length of the State, and in localities now untouched, but before long to be brought on the market.

The total output of this property up to the first of this year has been about 750,000 gross tons, and at the present rate of consumption, say 250 tons a day, if dead work were to stop, there is enough ground opened to give four or five years' supply. The bottom of the lowest level is in solid ore everywhere, and the depth to which the ore may run, is, of course, unknown.

At the Lowmoor Mine, a few miles away, a shaft has been sunk below water level 200 feet, with the ore in first class condition. Now, as to the quality of the ore. The glowing accounts going the rounds of high grade ores to be found in Virginia are misleading and inaccurate. As a rule, picked samples are taken for analysis and the results given as indicative of usual conditions. The following is the average of a number of analyses of picked lump:

Water	13.75
Silica	3.90
Alumina	2.50
Oxide iron	78.94
Oxide manganese	0.34
Lime	0.14
Magnesia	0.34
Phos. acid	0.35
Sulphur	Trace.
Total	100.26
Iron	53.26
Phos	0.064

These are visitors' and promoters' samples.

The result of analyses of a large number of furnace samples is:

Metallic iron	48.09
Oxygen	20.48
Water	10.37
Silica	15.16
Alumina	2.81
Sulphur	None.
Phos	0.482
Manganese	0.83
Lime	0.28
Magnesia	0.24

The manganese and silica are the main sources of trouble; the manganese, according to most competent furnace authority, frequently running up to 2 to 3 per cent. There is, however, an authority from which there can be no appeal, and which the writer personally and carefully obtained. The average yield of the ores, working by themselves, of one furnace in the district, is only 40 per cent. of iron, and the highest reached by any furnace does not exceed 43 per cent.

The massive lump ore is principally found near the surface, and steadily decreases in depth, over three-quarters of the ore as mined being wash; and it is the wash ore that carries the high silica. A safe business calculation requires that wherever the great Oriskany ore beds are found and worked, fancy percentages of iron must be discarded. As these ores are found in immediate proximity to high grade limestones, and with splendid coke, at moderate cost, available, they form one section, at least, of a broad and stable foundation upon which a magnificent industry may be erected.

The brands of pig iron made by the furnaces working these ores exclusively are noted far and wide for their excellence, both for foundry and mill purposes.

CLINTON, No. V.—The red hematites, or fossil ores No. V of Professor Rogers, as far as Virginia is concerned at the present time, have simply a speculative interest, as they are nowhere mined or used in the State; but they are well known from Northern New York to Alabama. The maximum thickness of the bed is at or near Birmingham, Ala., and thins as it runs northward to 6, 5, and 3 feet, and down to 18 inches of good ore in Northern Virginia, Maryland and Pennsylvania. Necessarily, there are local variations, some localities showing a greater thickness of bed than others. It is therefore not safe to predicate what one locality is going to do by what has been found at another. There is

very large amount of this ore to be had at a very reasonable cost, with proper mining. There is one point to which too little attention has been given, and which becomes a very serious factor in determining quantity. Of course, the promoter does not want to recognize the fact, but fact it is, beyond any peradventure, and by overwhelming evidence, that a marked change takes place in this ore below water level, the iron in it running down, and being replaced by carbonate of lime or silica. Over very large areas now worked, a soft fossil ore above water level, that shows from 52 per cent. to 55 per cent. of iron, and oftentimes not more than a trace of lime below water level, gives 28 per cent. to 34 per cent. iron, with carbonate of lime from 18 per cent. to 30 per cent.

At least one large furnace plant in the South, running principally on this lean, hard ore, uses no limestone whatever in its burden.

The published prospectus of the Big Stone Gap Company states that about 2 miles from that place, on the line of the South Atlantic and Ohio Railroad, this ore has been opened up at the base of Wallens Ridge, and shows a thickness of 39 inches of excellent soft ore. In the *Virginias* (May number, 1880, page 78), may be found an article by M. P. N. Moore, then connected with the Geological Survey of Kentucky, on the "Iron Ores Near Cumberland Gap, Va.," which is a succinct, clear and forcible article on fossil ores. He found there two workable seams of ore—one soft, averaging 20 inches, and one hard, of 27 inches—about 75 to 100 feet apart. Careful sampling by him gave:

	Soft ore. Per cent.	Hard ore. Per cent.
Ferric oxide	73.935	47.965
Alumina	5.776	2.130
Carbonate of lime	4.510	1.250
Magnesia	0.266	0.194
Phosphoric acid	0.319	0.575
Sulphuric acid	0.000	Trace.
Silica and insoluble silicates	11.730	43.690
Combined water	3.850	4.000
Total	100.386	99.784
Metallic iron	51.754	33.575
Phosphorus	0.140	0.251

On the Massanuton Mountain, over 200 miles to the northeast, and fronting on the west, the Shenandoah Valley Railroad, the same seams exist. Frederick Prime, Jr., is authority for the statement that on this mountain the ore is known as the "hard" and "soft" "fossil ores," according as the predominant impurities are silica or lime. This differs from the conditions existing in lower Tennessee and Alabama, but seems to verify what Mr. Moore found.

It is worse than folly to attempt to state with any precision what amount of workable ore can be found at any single locality, but we can safely sum up the general situation. This lead of ore is a stratified bed or seam; it extends, with variations as to quantity, but of a fairly positive quality, the length of the State. It is in reasonable proximity to railroads built and building, and with proper methods it can be profitably worked. Whether or not under water level it loses its commercial value, there is, in the aggregate, a large amount to be had above water level. The soft ore will be of great value for admixture with the silicious brown ores, especially in view of the fact that, as a rule, it carries low manganese and phosphorus; and it is likely to prove a factor of no mean importance in the future iron operations of the State.

Under No. V comes the Medina sandstones, No. IV, of Rogers. In these measures are to be found large veins of what enthusiastic land owners want to be iron ore; but it is simply a ferriferous sandstone, carrying from 18 per cent. to 30 per cent. of iron, and from 30 per cent. to 55 per cent. of silica, and, of course, worthless for furnace use.

No. III of Rogers requires especial mention, as it carries valuable brown ores over considerable areas. They can be made readily available on Purgatory Mountain, near Buchanan, Botetourt County, Va., and the projected Western Virginia Railroad from Buchanan to the Kentucky line *via* Catawba Creek and Moccasin Gap will open up many miles of these ores Recent investigations seem to point to large deposits lying in a fairly regular condition and susceptible of easy and cheap mining. A series of samples taken by E. D. Frazier, a careful and conservative prospector, and analyzed by P. G. Salom, of Philadelphia, gave as follows:

	Per cent.
Metallic iron	43.61
Alumina	3.88
Silica	18.75
Sulphur	0.04
Phosphorus	0.48

The manganese, unfortunately, was not determined, but it is safe to assume that it will follow the usual run of mountain brown ores of from 0.6 to 1¼ per cent.

We are now brought to the consideration of what we may fairly assume to be the great ore bearing measures of Virginia—I and II of Rogers.

No. I.—The Valley of Virginia is a part of the great valley extending from Canada to Alabama, and noted for its rich, fertile limestone lands, its great iron ore beds, its pure waters, its bracing health-giving climate, and its varied and picturesque scenery. It is called in New York the Walkill Valley, in Eastern Pennsylvania the Kitatinny, in middle Pennsylvania the Lebanon or Cumberland, in Virginia the Shenandoah, James River, Roanoke and New River, and further South, the East Tennessee Valley. The Shenandoah Valley and the Norfolk and Western railroads run through its entire length, for many miles along the base of the Blue Ridge, which holds the Potsdam sandstones throughout, and on the top of which are the ferriferous shales, carrying the great brown ore deposits of the country. These ores widely vary in quantity, quality, and conditions, but in the aggregate seem to promise indefinite quantities. The occurrence of the ore is thus described by Prof. W. M. Fontaine of the University of Virginia. "We cannot in strictness call any of the deposits of the ferriferous shales veins or ledges, although ore may be, and usually is, found along certain definite bands. The deposits are tenticular masses or interrupted sheets of ore, that occur sometimes alone, or sometimes overlapping, in echelon, or more rarely radiating from a central point. Lines connecting the several masses in the direction of their greatest dimensions would fall within certain bands, and one mass may lie on the same line with another, so as to produce the appearance of one ledge or vein. The sheets and masses will, however, be found to be entirely enclosed in clay, and they are all formed by the concentrating action of concretionary forces that have collected this once diffused iron into masses that have more or less distinctly a concretionary structure, or that form beds of nodular ore, or crusts lying in an enclosing clay."

While the general direction of the lead of ore is northeast and southwest, at places there are very great deflections, especially at the end of ridges and the foot of hills, where the ore will take a new direction, almost at right angles to the true lead.

Necessarily, under the old charcoal practice, the quantity of ore required was very small, and no mining, in the proper sense of the word, was done. When the ore outcropped and looked well, shallow pits would be opened on it, and as soon as one opening reached 10 or 20 feet in depth it would be, as a rule, abandoned, and another surface point attacked. With the advent of the large coke furnaces a different course was required. What may be reasonably looked for from these deposits can be best illustrated by an active mine some 12 miles from Roanoke and owned and operated by the Crozer Iron Company. It lies well up on the mountain, some 400 feet above the water drainage of the locality. The ground was opened in 1882 and 1883 and has been worked continuously ever since, and, until very recently, as an open cut over a large area. In some places the ore ground runs to the surface; in others there is a clay covering from 2 to 20 feet. This piece of ground to the careful observer becomes a complete and exhaustive object lesson. There is to-day, ahead of a long and wide open cut, a face of at least 60 feet of wash ore ground, interspersed with boulders of solid ore of varying sizes, that will yield all through 1 ton of washed ore to 3 tons of dirt handled. On the floor of this cut a shaft was sunk for 60 feet through solid wash ground. A tunnel to strike this depth was driven for 1500 feet. The ore ground was struck at 400 feet, and the tunnel was driven for 1100 feet through, and leaving off in ore ground that gives 75 per cent. of ore in the dirt handled. On the floor a well was sunk for 30 feet through the same character of ground. The depth to which the ore may run is unknown, but over a large area the ore has been proved to be 150 feet deep, with no signs whatever of exhaustion.

Many hundreds of analyses of these Potsdam ores have been made, covering every section of the ground between Maryland and Tennessee, but of which only a summary of the extremes can be given:

Metallic iron from 38 per cent. in wash to 57 per cent. in picked lump.
Silica from 22 per cent. in wash to 3 per cent. in picked lump.
Manganese, from 0.10 per cent. to any per cent.
Phosphorus, from 0.10 per cent. to 3.5 per cent.
Alumina, from 0.5 per cent to 3 per cent.
Lime, under 0.75 per cent.
Magnesia, under 0.50 per cent.
Sulphur, as an almost invariable rule, in the hundredths of 1 per cent., or inappreciable.

Two furnaces in the district, largely using these ores, have very kindly stated the results reached over a long time as to the average yield of these ores when prepared, showing from 44 to 46 per cent. of iron. In the main, lying in such close proximity to the railroads, the various deposits are readily reached by short branches of 1 to 6 miles in length.

No. II.—Along the Cripple Creek Extension of the Norfolk and Western Railroad, running through Pulaski and Wythe counties, and extending south-westerly well toward the North Carolina line, is another large ore field deserving particular notice. It is generally known as the Cripple Creek region, and contains a brown ore that has been famous in the past for its particular excellence in charcoal irons. It is unquestionably the highest grade of brown ore known in Virginia. It lies on the Lower Silurian limestones, No. II., in varying quantities, according to the folds of the limestone, but always of excellent quality. It is practically all worked in open cuts. The ore generally lies in a loamy, friable clay, but at times horses of a heavy, unctuous clay (locally called "buckfat") intrude. In some cases the deposits of ore ground are shallow and at other times deep. The richness of the ground varies greatly—at times 4 yards of dirt yielding 1 yard of ore, at other times 12 to 1. The average of the district is stated as about 8 to 1. It is dug and handled with extraordinary ease and

cheapness where the ground is properly opened up and good washing facilities afforded. It shows, by innumerable analyses and by continued furnace workings, a yield of over 48 per cent. of metallic iron, at times running up to 50 per cent. and 52 per cent., and for a brown hematite extraordinarily low phosphorus and manganese. The following analyses by A. S. McCreath are fairly characteristic of the ore :

	Per cent.
Sequioxide of iron	76.214
Sequioxide of manganese	0.055
Oxides of nickel and cobalt	0.040
Alumina	2.360
Lime	0.820
Magnesia	0.480
Sulphuric acid	0.157
Phosphoric acid	0.171
Water	12.072
Silicious matter	7.480
Total	89.856
Metallic iron	53.350
Manganese	0.036
Sulphur	0.063
Phosphorus	0.075

It can readily be seen that this ore plays a very important part as an admixture with the Potsdam ores, with their higher phosphorus and manganese. How long these deposits can stand a persistent, heavy drain upon them it is impossible to definitely say, but that they are available for many years to come is unquestioned.

In leaving the brown ores of Nos. I and II it seems not amiss to call attention to the important part they may play in the near future in the manufacture of basic, and especially of open hearth basic, steel. Low silicon is the rule in all the irons produced in the district, and a great difficulty in the past has been to get high silicon in foundry irons. The writer has personally known of a lot of forge irons, taken at random out of stock in the furnace yards, and a score of analyses made by thoroughly competent chemists, where the silicon ran from a minimum of 0.30 per cent. to a maximum of 0.70 per cent. and an average of less than 0.50 per cent. By watching the ores as delivered, and properly charging the furnace, any desirable percentage of phosphorus and manganese whatever can be absolutely secured. Virginia can be considered as one of the few natural homes of basic steel.

Incidentally, ore washing has been spoken of above. With the exception of the lump, which will not exceed one-quarter, if that, of the output of the mines, the brown ores of the whole district, whether No. I, II, III or VII, have to be washed to free them from the enclosing clays. One well constructed double log washer will give an output of from 80 to 100 tons of ore per working day, according to the nature of the ground; and a picking belt attached thereto enables the washed ore to be freed from lump and pebbles of free silica. As a rule, jigs are not used, as generally they are not needed.

Before considering the last and oldest of the ore-bearing rocks of Virginia (Archæn), a single word may be said in relation to a so-called "ore," lying to the eastward and under the Potsdam sandstones. It has been heralded far and wide as a Bessemer specular ore, in unlimited quantities, and as of inestimable value. It is neither. It is simply a ferruginous sandstone, which can be traced along the Blue Ridge from one end of it to the other. It lies in stratified seams, of from 2 to 6 feet in width. Ordinarily, it carries under 30 per cent. of iron, and anywhere from 30 per cent. to 60 per cent. silica. At one or two points there is a local improvement, which brings the iron up to 40 per cent. and the silica proportionately down. In such cases it is used in very small quantities to mix with the rank cold short brown ores to dilute the phosphorus and manganese, from which it is almost free. There has been purposely left to the last a source of supply which is unique, and destined, in the writer's judgment, to have a widespread influence upon the iron business of South-western Virginia —the gossan ore fields of Carroll County. For many years in the "long ago" this ore was worked in a small charcoal furnace in Floyd County, which adjoins Carroll, the iron requiring many miles of transportation over wretched country roads to reach a market. The output of the furnace was put mostly into castings for local use, and acquired wide notoriety by reason of the strength, toughness, and durability of the castings. Car wheels made from this iron proved of extraordinary lasting power and tenacity, the latter undoubtedly owing to the copper contained in the iron. Practically, however, the iron ore was of no value, the properties being worked for the copper underlying the gossan. In consequence there is a splendid and unusual opening up of the ground by many hundred feet of tunnels and shafts, at different points. The lode dips at an angle varying from 40° to 70°, and also varies very greatly in width. There are at places surface widths of 300 to 500 feet. A conservative estimate would make an average width of say 50 feet throughout the whole lead, and an average depth of, say, 30 to 40 feet. In many places the ore comes directly to the surface, and generally has only from 2 to 5 feet of stripping. The lead is cut at frequent intervals by ravines, making the working of the ores almost child's play. There is no mining whatever. It will be an open cut or quarry, in which the ore is broken down and delivered to the cars. It is probable that a certain percentage of fine ores, lying near the surface and next to the walls, and somewhat mixed with the mica slates, may require washing, but the bulk of the ore quarried can be loaded directly into the cars. The following is the average of a large number of analyses sampled by experienced furnacemen and determined by competent chemists. It is proper to say that the samples were taken over a large area, from near the outcrop in the tunnels and shafts, and fairly represent the character of the ores:

	Per cent.
Metallic iron	50.275
Silica	8.335
Phosphorus	0.075
Alumina, from	2.5 to 4.00
Sulphur	0.486
Manganese	0.224
Lime, from	0.20 to 0.400
Magnesia	0.789
Copper	0.442
Lead	0.407

It is safe to assume that with proper care the ore can be had on a commercial scale to average 45 per cent. of iron.

One important statement remains to be made. It must be borne in mind that under the gossan occur the oxides of copper, red and black, with the carbonate in seams in the adjacent gossan. Below this follows the lode holding the gray and black sulphurets; beneath these the mundic rock to an unknown depth.

A diamond drill hole has, within the last few months, been drilled to the depth of 110 feet through, and leaving off in the mundic rock, which is a sulphuret of iron and copper. Two tests were made by roasting this mundic rock, simply for iron and sulphur. A pile of the mundic from near the surface was roasted with wood, and a piece of the drill core, at a depth of 110 feet, was heated in the laboratory, with the following results:

	Surface mundic before roasting. Per cent.	After roasting. Per cent.
Iron	54.26	63.96
Sulphur	33.97	0.623

	Drill hole mundic before roasting. Per cent.	After roasting. Per cent.
Iron	53.13	51.91
Sulphur	33.22	0.527

Assuming that modern experience and appliances can successfully handle this material on a commercial basis, so as to expel the sulphur, leaving the iron, the quantity to be obtained for this purpose is simply incalculable. Another "Blue Billy" factory can be started in this country. It is hard to conceive the effect upon the iron industries of Virginia, in consequence of the opening up of these ores. As the writer has had occasion to remark elsewhere, it is possible, by varying the mixtures in the furnaces, to produce every grade of iron. As far as known, this is the first red short ore that has to this date been made available in the South. It can be used by itself, or mixed with the brown ores of the district in close proximity, to produce a rank or mild short, neutral or slightly cold short iron, while certain of the brown ores will give a rank cold short iron. For castings, especially small ones for shelf hardware, &c., a low-priced iron can be made as fluid as water, and of very great strength. Its great point of value is that by admixture it will permit the use of hundreds of thousands of tons of the mountain brown ores capable of being cheaply mined and handled, that now, owing to their large percentages of phosphorus and manganese, are useless for present purposes. It is proper to state, in this connection, that very large deposits of this gossan are reported in Tennessee, on the south western extension of the lode, but at present unavailable by reason of distance from any railroad. The gossans of Carroll are now reached by rail from the Norfolk and Western Railroad at two points—at the north-eastern end by a branch road, 13 miles long, from the Cripple Creek Extension at Big Reed Island Creek, 25 miles from Pulaski, 37 miles from Max Meadows, 117 miles from Bristol, 52 miles from Radford, 89 miles from Salem, 96 miles from Roanoke, and 149 miles from Lynchburg. The lower or south-western end of the lode is now reached by the Norfolk and Western Extension of the Cripple Creek Railroad, to meet the Cape Fear and Yadkin Valley Railroad, at the North Carolina line. This brings this part of the lead within 17 miles of Ivanhoe, 49 miles of Pulaski, 64 miles of Radford, 108 miles of Roanoke. It follows that this ore is commercially available at every furnace, either now blowing or building, or projected on the line of the Norfolk and Western and Shenandoah Valley railroads.

High grade limestones and dolomites are to be had everywhere through the great Valley of Virginia, and it is not necessary to encumber this paper with detailed descriptions or analyses.

In considering the possibilties of Virginia as an iron producing district, it would be manifestly improper not to call attention to the fuels available, as no matter how large the quantity, or how cheaply obtained the ores might be, they could not be utilized in the absence of a proper fuel.

The merits of the Flat Top coals and coke are now too widely known to warrant elaboration. The excellence of the coking coals of the New River district, on the Chesapeake and Ohio Railroad, has been too well tested in furnace practice for years past to admit of a doubt. The coking coals of the New River (Chesapeake and Ohio Railroad), upon which the furnaces at present working the Oriskany ores (No. VII, as above) depend, are elaborately treated by J. C. White, a recognized authority, in his report to the United States Geological Survey in 1884. He gives three seams of coal: The Nuttall, with its geological horizon on New River, about 400 feet below the top of XII; the Quinnimont and Fire Creek, from 300 to 400 feet below the Nuttall. These seams run from 3 feet to 4 feet in thickness. The coal literature of the country has been flooded for the last 10 to 15 years with

analyses of all these coals and coke. Of course these vary according to the samples taken. It is believed that the following are fairly representative:

Coals.

	Quinnimont.	Fire Creek.	Nuttall.
Fixed carbon...	75.89	75.02	70.67
Volatile matter	18.19	22.34	25.35
Ash.....	4.68	1.47	2.10
Sulphur.....	0.30	0.56	0.57
Water.....	0.94	0.61	1.35

(Trans. Amer. Inst. Mining Engrs., Vol. VIII, page 261.)

Coke.

Carbon.....	93.11	92.18	92.22
Ash.....	5.94	6.68	7.53
Sulphur.....	0.82	0.61	0.92

(T. Eggleston. Dr. Ricketts. C. E. Dwight.)

The percentage of ash in the Fire Creek and Nuttall cokes is entirely too high for the ash shown in the coals, but the chances are that the coal samples were picked, while the coke shows the run of the mines.

The Flat Top seam, with its magnificent thickness of 6 to 11 feet, must necessarily be the source of supply to all of the furnaces located on or near the line of the Norfolk and Western road, and it is in this section where the large present and near future development is taking and must take place.

A. S. McCreath, for many years connected with the Second Geological Survey of Pennsylvania, in an elaborate report on the New River and Cripple Creek mineral region, lately published, has a valuable addenda on the limestones and coals and coke, and from these the following are taken:

Flat Top coals, averaging 15 samples:

Water.....	1.011
Volatile.....	18.812
Fixed carbon.....	74.256
Sulphur.....	0.730
Ash.....	5.191

From three large works at Pocahontas, in active operation, he selected samples of coke, which gave as follows:

	No. 1.	No. 2.	No. 3.
Water.....	0.182	9.196	0.664
Volatile.....	0.719	0.494	1.059
Fixed carbon..	92.248	92.585	92.816
Sulphur.....	0.565	0.677	0.913
Ash.....	6.286	6.048	4.913
Totals.....	100.000	100.000	100.000

As one of the possibilities of successfully making iron in Virginia, it does not seem unfair to make the following comparison, as quoted by Mr. McCreath, especially as the analyses of the cokes of other districts have been for a long time public property:

	Water.	Volatile.	Fixed carbon.	Sulphur.	Ash.
1. Pocahontas coke, average of three samples	0.347	0.757	92.550	0.597	5.749
2. Birm'ham, Ala., average of four samples.....	0.157	0.803	87.299	1.195	10.545
3. Chattanooga, Tenn., average of four samples	0.447	1.101	80.513	1.595	16.344
4. Connellsville, Pa., average of three samples..	0.000	0.427	88.902	0.810	9.741

The growth of the Flat Top coals from nothing in the census year of 1880 to nearly 2,000,000 tons in 1890, and of coke from nothing to many hundreds of thousands of tons, with an increasing demand which present facilities cannot possibly meet, tells the story of what it is.

The following table of distances to furnaces now in operation, building, or projected, may prove not uninteresting:

From Pocahontas to Graham, 10 miles; to Radford, 75 miles; to Pulaski, 90 miles; to Max Meadows, 103 miles; to Bristol, 182 miles; to Ivanhoe, 122 miles; to Salem, 112 miles; to Roanoke, 119 miles; to Lynchburg, 172 miles; to Glasgow, 163 miles; to Buena Vista, 173 miles; to Basic City, 215 miles, and to Shenandoah, 251 miles.

The cokes from the New River district on the Chesapeake and Ohio Railway, 112 miles to Lowmoor, 118 miles to Longdale, 121 miles to Wilton, 133 miles to Goshen, 160 miles to Glasgow, 175 miles to Buena Vista, 198 miles to Lynchburg, 178 miles to Basic City and 214 miles to Shenandoah.

It is not within the province of this paper to give any figures of cost. The reader must form his own conclusions, based upon his own experience, as to the prices at which materials of the quality as given and lying in proximity as described can be handled by prudent and practised business men. The visitor interested in obtaining information on this point will find abundant sources to gather what he desires.

The writer claims the right to say that with a large personal knowledge of different mineral sections of the country, and with no desire to detract in any way from the merits of many other districts in this favored land lavishly blessed by nature, that taking into consideration the variety and position of the various mineral resources of Virginia, it is the most remarkable and interesting mineral field that has ever come under his examination.

In closing this unreasonably, but unavoidably, lengthy paper, he desires to express his acknowledgements for the information obtained from the valuable papers and reports of Drs. W. H. Ruffner and Egleston; Professors Campbell and Fontaine; Messrs. Prime, Moore and McCreath, and especially to the invaluable publication by Major Jed Hotchkiss, of Staunton, Va., of *The Virginias* from 1880 to 1885.

Papers were also presented as follows: "The Manufacture of Spirally Welded Steel Tubes in the United States," by J. C. Bayles; "The Coke Industry of the United States," by J. D. Weeks, and "Testing Materials of Construction in the United States," by Messrs. Hunt and Clapp.

The Holley Memorial.

On Thursday afternoon the ceremonies attending the unveiling of the bust of A. L. Holley took place. The address was made in Chickering Hall by James Dredge, editor of *Engineering*, who, owing to his long and intimate acquaintance with Mr. Holley and the high appreciation of his work, was well fitted for the duty. We take the following extracts from the address:

In 1857 I was the first person to shake hands with Holley on his arrival in England. Twenty-five years later I was the last Englishman to shake him by the hand in London, when we said our final farewell. You cannot imagine the effect which the sudden apparition of the two young Americans, Holley and Colburn, in the gloomy London office, had upon me. They appeared to me like beings from a superior world, so unlike were they to any persons I had ever met before. Even with my untutored and crude power of perception, I could feel that they were surrounded with an atmosphere of energy and intelligence; that they were overflowing with vitality. The one seemed to me a spirit of darkness, the other a spirit of light; and both so immeasurably my superiors that I could do little more than gaze on them in wonder.

With Holley's return to America in 1858, or shortly afterward, began the journalistic epoch of his career. For some years he was a valuable and industrious contributor to the New York *Times*, and certainly never before or since has any daily newspaper been so fortunate in the services of an engineering contributor. In 1859, and again in 1860, he visited England, chiefly to write upon a subject which was then attracting the attention of the civilized world—the Great Eastern.

He was employed by Mr. Stevens in 1862 to visit Europe in order to obtain information that might be useful in the construction of the Stevens battery, on which so much time and money, as well as skill, were wasted. Mr. Scott Russell, who at that time had considerable interest in naval and military circles, rendered Holley good service in obtaining for him introductions and information, while his own presence of mind and coolness often stood him in good stead in obtaining access to places the official doors of which were closed against him. It was this new connection that turned his mind to the production of that important hand book on "Ordnance and Armor," which, when completed, was destined to remain for so many years the standard book of reference on the subject.

When this book was published the art of heavy gun construction was far more tentative and experimental than it is now, and the classified collection of all information available up to the date of its publication served as a great aid in advancing a science then in its infancy. The strictly literary period of Holley's career was now drawing to a close, and though he could never, as long as he lived, abandon his innate love for writing, he was no longer compelled to rely on his pen as a means to live. In May, 1863, he finally decided upon turning his talent and energies into another channel, one that was destined to lead him to fame and moderate prosperity.

The practical value of the Bessemer process for manufacturing steel had by this time become widely recognized, and it followed almost as a matter of course that Holley, who was always on the lookout for some new and good thing, felt intuitively that the time for which he had so long waited had at last arrived.

The Sheffield Bessemer Works in 1864 were on a very small scale; they comprised only two 3-ton converters and a corresponding plant. Holley came from America upon this business as the representative of Messrs. Corning, Winslow & Co., a firm that was afterward changed to Winslow, Griswold & Holley. His mission was to purchrse the Bessemer patents for the United States; to learn the process, and afterward to inaugurate the new industry at home.

After the return of Holley to America in 1864 the Troy works were started, and the first charge of Bessemer metal was made on February 16, 1865. Let me refer you to R. W. Hunt's interesting paper on the original Bessemer steel plant at Troy, read before your Society of Mechanical Engineers in 1884. You will see from it that Troy was only a small works with two 2-ton converters, but such capital steel was produced that enterprise and capital were convinced. During the month of May, 1865, less than twelve weeks after the works were started, eighty charges were made, giving 118 tons of steel with 16.7 per cent. of loss; immediately after this the works were extended by the installation of a plant that included two 5-ton converters; Z. S. Durfee assumed the charge of the establishment, and Holley proceeded to construct steel works in other parts of the country, commencing with those of the Pennsylvania Steel Company at Harrisburg.

The thorough efficiency of the Bessemer process having been thus demonstrated, there was no limit to the supply of capital required for the erection of steel works, and Holley rapidly found himself almost unable to satisfy the demands made upon him for designing and starting new es-

tablishments. He, however, never knew what it was to have too much occupation, and the finest steel works in your country bear evidence of his skill and industry, those of North Chicago and Joliet; the Edgar Thomson Works, at Pittsburgh; the Vulcan Works, at St. Louis; the Cambria, the Bethlehem, the Scranton and other works, were built under his instruction and from his plans.

The professional honors that were so fully his due fell thickly enough on him during the later years. He was elected president of your Institute of Mining Engineers in 1875; he was vice-president of your Society of Civil Engineers in 1876; founded your Society of Mechanical Engineers, of which society you did me the high honor to elect me an honorary member; in 1877 he became a member of the Institution of Civil Engineers, a body which we in England are proud to regard as the parent of all the Anglo-Saxon engineering societies.

Holley was proposed as a member of the Institution of Civil Engineers by the late Sir William Siemens, and was seconded by a long list of well known and famous men in the profession. They were: F. J. Bramwell, E. A. Cowper, T. R. Crampton, James Ramsden, J. T. Smith, Alexander Brogden, B. Baker, John Hawkshaw, W. H. Barlow, Charles Hutton Gregory, Douglas Galton, I. Lowthian Bell.

Holley was also a member of the Iron and Steel Institute of London. In 1875 he was appointed a member of the United States Board for testing structural materials; in 1879 he became a lecturer on the metallurgy of iron and steel at Columbia College, and in 1878 he was given the degree of Doctor of Laws.

Unveiling the Statue.

The further ceremonies took place in Washington Square, the site selected. The statue is a colossal bronze bust by J. Q. A. Ward. The likeness is remarkably truthful and impressive, and is erected as a fitting tribute by the engineers of the two hemispheres. As a work of art the memorial ranks among the foremost of its kind of which New York can boast. The bust represents the subject wearing an overcoat of rough material, which is turned to artistic account in lieu of the conventional toga and drapery. On the plinth right and left are sprays of laurel and oak. The pedestal is handsomely designed. The rectangular die rising from two steps is surmounted by an ornate cap, the whole being 8 feet high. It is flanked by two wings somewhat over 3 feet high and 4 feet wide, jutting from near the back and terminating in rectangular posts with terminal ornaments.

The inscriptions on the face are in raised letters, the places and dates of birth and death being on a tablet and four rosettes being used as ornaments. The inscriptions are as follows:

HOLLEY.
Born in Lakeville, Conn., July 20, 1832.
Died in Brooklyn, N. Y., January 29, 1882.
In Honor of
ALEXANDER LYMAN HOLLEY
Foremost Among Those
Whose Genius and Energy
Established in America
And Improved Throughout
The World the
Manufacture of
Bessemer Steel,
This Memorial is Erected
By Engineers
Of Two Hemispheres.

The work in all its details will bear the closest criticism and is honorable alike to the deceased and those who would perpetuate his memory.

Excursions.

On Friday afternoon parties were made up to visit the Navy Yard and points of interest on the East and Harlem rivers, the Tilly Foster Mines, the Edison Laboratory, the Brooklyn Bridge, Spiral Weld Tube Works, Passaic Rolling Mills and the Hudson River Tunnel.

The annual banquet of the Iron and Steel Institute took place on Thursday evening at Delmonicos.

En Route to Philadelphia.

Two special trains were required to transport the visitors from abroad and their American friends from this city to Philadelphia last Saturday morning. A stop was made at Tacony, and the great saw and file works of Henry Disston & Sons were visited. At these works the party was met by the Philadelphia Local Committee. After the works had been thoroughly inspected, the visitors having been judiciously divided up into small parties, a trip was taken down the Delaware River, lunch being served on the boat. A speech of welcome was made by Joseph D. Potts, chairman of the Local Committee, and head of the iron firm of J. D. Potts & Co. Mr. Potts said:

There has been assigned to me by the Committee of the Engineering Societies of Eastern Pennsylvania the most agreeable duty of bidding you all a very hearty welcome to our borders. We wish you to feel at home. We will do our best to make you feel at home while you are with us. We will show you something of what we have done and of what we are doing in the great march of mankind toward better living for all, and particularly in that phase or department of human progress called industrial development, the yoking of natural forces into the service of mankind, so that mankind itself may be made freer from the harsh dominion of necessity and of circumstances.

We hope, when your visit shall be over, that you may be able to say that we are keeping a fairly even step in this regard with the great procession of civilized nations. You will find we are eclectic. We are not provincial enough to reject other people's conclusions when they seem to be better than our own. In accomplishing our recent large growth in the production of iron, for instance, you will find that we owe much to the masterly investigations and deductions of Sir Lowthian Bell, and much to the labors and experiments of many other eminent Europeans. The liberal spirit which has led you to place all these potencies at the world's service is as worthy of enduring fame as is the intelligence which unveiled them. We believe you may find among us some fresh physical discoveries of our own, and some new and successful applications of old knowledge, suitable for use in your processes at home. We hope you may do so. We certainly owe you a *quid pro quo*, and this is a debt which I am sure it will be our pride to pay whenever we can.

Sir James Kitson replied on behalf of the metallurgists and iron men, and thanked Mr. Potts for the cordiality and hospitality with which they had been received. During the luncheon the steamer had made rapid progress down the river, and was soon abreast of Chester. A brief stop was made there for the purpose of allowing the visitors to catch a glimpse of the industrial establishments of that city. The run down the river was then continued as far as Wilmington and Newcastle.

Monday morning a trip was made to Phœnixville, where the works of the Phœnix Bridge Company, and the furnaces and rolling mills of the Phœnix Iron Company were inspected. The establishments of Geo. V. Cresson, the Harrison Boiler Works and the Link Belt Engineering Company were also visited. Another party visited the mammoth establishment of the Baldwin Locomotive Works, after which they went to the tool works of William Sellers & Co. Still another party visited the Camden Iron Works of R. D. Wood & Co. On Tuesday the entire party visited Mount Gretna Park, and made a trip over the 2-foot gauge "Governor Dick" railroad to the summit of South Mountain. The Cornwall ore hills and blast furnaces were also examined, and a stop was made at Lebanon.

The Joplin Ore Fields.

Within the last few months great activity has characterized the lead and zinc mining industry in the Joplin district. A great many new prospect shafts have been sunk by individual miners and by parties of limited capital who have organized to buy in small tracts of mining land. Operations are being extended into new territory and some strikes of considerable value have been made by these small operators. Joplin to-day presents the feverish, all expectant aspect of a frontier mining town more than at any other time. The streets are filled with a steady throng of operators, speculators and miners, and the one subject of conversation is "Jack." It is claimed that there is no boom there, such as was so disastrous to so many Kansas towns, but some recent transactions in mining lands indicate strongly a tendency in that direction. There is this, however, in favor of Joplin, that the dependence of the town is not on the future growth of the country round about, but on the immense beds of ore which underlie that whole country and which have not yet been developed to anything like their limit of production.

A syndicate from St Louis and Kansas City has just acquired valuable rights in a water front on Shoal Creek and has let the contract for a complete electrical plant to furnish power and light for the town, and also to furnish power for a line of electrical street cars which will connect the town with the outlying mining camps and with East Joplin. Both Webb City and Carterville show increased activity, and all this county (Joplin), as well as Southwest Missouri in general, shows a decided increase in population in the past decade, with indications for its continued growth. Joplin is agitating the erection of a mineral palace such as Pueblo, Col., has, but it is yet only in the distant future.

It is definitely stated in Chicago that the Great Northern Manitoba Road will have its Pacific Coast line in operation within a year. It will cross the Union Pacific and Northern Pacific roads in Washington. Its Pacific Coast terminal will be south of Portland, with branches in that city and Seattle. As surveyed, it will be 250 miles, the shortest route from the Pacific to St. Paul.

The Iron Age

New York, Thursday, October 9, 1890.

DAVID WILLIAMS, - - - PUBLISHER AND PROPRIETOR.
CHAS. KIRCHHOFF, JR. - EDITOR.
GEO. W. COPE, - - ASSOCIATE EDITOR, CHICAGO.
RICHARD R. WILLIAMS - - HARDWARE EDITOR.
JOHN S. KING, - - - - BUSINESS MANAGER.

NOTICE.

A few copies of *The Iron Age*, January 16 and February 6, 1890, wanted to complete files. Subscribers having papers of the above dates will confer a favor by sending them to John S. King, manager, 66 and 68 Duane street, New York.

Reciprocity Treaties.

The course of our foreign trade is likely to undergo some radical changes in the near future as a consequence of recent legislation. The power placed in the hands of the President to retaliate against the trade of the countries now discriminating against American products is in a fair way to be speedily applied if the practice is not corrected. In view of the higher duties on many of their manufactured products imposed by the new Tariff act, it is apparent that France and Germany will not feel in a conciliatory mood when the adjustment of freer trade relations for American interests is broached. Should they refuse to meet the views of our Government, and retaliatory measures are put into force, a war of tariffs will result that may have more serious consequences than any one now foresees. Our imports from both countries are considerably larger than our exports to them, and this fact may have much to do with an amicable settlement of the controversy, unless it be assumed that our new tariff will restrict French and German imports so as to soon throw the balance of trade with them in our favor. Prudent statesmanship is needed to skillfully guide negotiations so as to avoid complications which will seriously unsettle many important business interests both here and abroad. Another very important feature of recent legislation is the reciprocity provision in the Tariff act, also investing the President with important powers and responsibilities. These measures commit the country to a new policy in foreign affairs, which is plainly the better cultivation of foreign markets for American products.

Protectionists and free traders seem to have at last arrived at a common point, as both classes now profess to be desirous of enlarging our foreign trade. They are, of course, not in harmony with each other as to the means to be adopted in securing this purpose. Protectionists seek to accomplish it through reciprocity treaties with countries whose products differ largely from those of this country, while free traders would open our ports to the commerce of the world without regard to the nature of the competition thus admitted in our home markets. Under reciprocity treaties our foreign trade will still be restricted, with the avowed object of shielding American producers from more advantageously situated foreign rivals. Hence those who desire free commerce with all the world denounce such treaties, and regard them merely as devices by which the protective principle may be more firmly rooted as a part of the governmental structure. Nevertheless, the disposition to look favorably on a scheme intended to increase our foreign trade must be regarded as an advanced movement on the part of Protectionists. Heretofore they have professed to be indifferent with regard to the question of exports, preferring that the country should confine its energies to meeting the home demand, letting the export trade take care of itself. The advocacy of reciprocity treaties is an admission that the work of protection in securing control of the home market has been so successful that the time has come when the opening up of foreign outlets for our products should be made one of the functions of the Government.

With a popular government, such as that of the United States, no rigid policy can be laid down for the conduct of public affairs, however strong the party adopting it may be. It is most remarkable that the protective policy has now continued for 30 years to dominate our tariff legislation. A favorable conjunction of events, operating singularly in the interest of protection, has prevented a return to low tariffs, although at times the possibility of such a change in our fiscal policy has seemed imminent. The advocates of reciprocity treaties may prove in time to have opened a way to free trade with all countries that would have continued tightly closed when otherwise approached. The arguments advanced by numerous advocates of such treaties are of a character to be very effectively used in coming tariff controversies by free traders. It is reported that negotiations are already on foot with some of our Southern neighbors which will possibly result in treaties in time to be placed before the United States Senate for ratification this winter. Much will depend upon their character and the products which under them will be admitted to this country free of duty. There are some very sensitive American interests which will be affected by several important products of Central and South America, and if these are touched there may be domestic questions of retaliation and reciprocity to be considered by Congress.

The shipments of Lake Superior iron ore have not shown the diminution which was so confidently anticipated in some directions but a few weeks since. The congestion at lower lake ports was then so pronounced that some of the best posted ore dealers believed that receipts would be seriously checked and that shipments would fall below those of last year by the end of the season. Contrary to their expectations, the ways and means have been provided for taking care of receipts so well that now there seems to be no doubt of a handsome increase being shown over last year when the season of lake navigation shall terminate.

Sheets for Tin Plate.

The passage of the Tariff bill has made many things certain which were previously dubious. Among these is the increased duty on tin plate, which was resisted strenously up to the last possible moment by those who doubted its expediency or were specially interested in the maintenance of low duties. Now that it is absolutely certain that after July 1, 1891, the rate of duty imposed on tin plate will be $2\frac{2}{10}$ cents per pound, an obligation rests on the manufacturers of iron and steel to get to work immediately and establish tin plate plants as rapidly as possible. They have assured their representatives in Congress that the only essential lacking for the production of tin plate in this country was an adequate duty. The new rate fixed by Congress is evidently regarded as meeting that qualication, since it has been named by tin plate advocates as a rate with which they would be satisfied. In one or two cases our manufacturers felt so well satisfied that the tin plate industry would be cared for in the new tariff that they did not wait for the passage of the act, but began to make their preparations in advance, and were actually turning out tin plate and terne plate on the day the bill was signed by the President. The enthusiasm thus shown was confined to but narrow limits, other manufacturers taking a more conservative view of the matter and preferring to wait for the final settlement before making any investment. Now, however, no time should be lost if American tin plate manufacturers hope to make a good showing within their probationary period. They must turn out a product equal to one-third of the imports of tin plate by October 1, 1896, or they will then be subjected to more severe competition from abroad than now, because tin plate will be put on the free list if they fail to do so. Under the circumstances it behooves those interested in this matter to look well into the supply of iron and steel sheets for tinning purposes, and understand thoroughly what lies before them. The statistics available on this point are of great interest.

Referring to the list of iron and steel works printed by the American Iron and Steel Association, it will be found that there are in the United States at present only 70 establishments engaged in the manufacture of iron and steel sheets. Of these quite a considerable number do not make a specialty of rolling sheets, but produce them in connection with other finished forms of iron and steel. There is not a sheet mill in all New England. New York contains one establishment making sheets as an incident of its product. New Jersey contains two sheet mills, but one of these can hardly be

classed among the regular sheet makers, because it merely produces taggers iron from tin plate scrap. In Pennsylvania there are 27 establishments making sheet iron and steel, but some of these only turn out small quantities, paying more attention to other products. Delaware has 4 concerns; Maryland, 1; Virginia, 1; West Virginia, 2; Kentucky, 5; Alabama, 2; Ohio, 21; Indiana, 1, and Missouri, 3; but in numerous instances these works make but small quantities of sheets. Estimating the sheet capacity of all these works on a very liberal scale, their annual production would fall below 220,000 gross tons if they were operated to their utmost output with existing appliances. The actual yearly production of iron and steel sheets in the United States is not separately stated in the statistical reports of the American Iron and Steel Association. Plates and sheets are classed together. Their production in 1889 is stated as follows:

	Net tons.
Iron plates and sheets.....	471,193
Steel plates and sheets.....	331,283
Total.....	802,476

This total is equivalent to 716,496 gross tons. Nail plate is excluded. It would be merely a blind guess to estimate what part of this quantity consists of sheets. According to the figures of capacity presented above, the sheet production could hardly have been above 175,000 tons, as actual production always falls considerably below estimated capacity. A very large part of this production of sheet iron and steel did not come upon the market as such. Much of it was galvanized, a great deal was corrugated, a considerable part was made up into articles for domestic use, and passed into consumption that way.

Now, with these facts before us, let us examine the statistics of tin plate imports. In the calendar year 1888 the quantity of tin plates imported was 298,238 gross tons, which increased to 331,311 gross tons in 1889. As the consumption of tin plate in this country is constantly increasing, these figures will be considerably augmented in the next year or two. Even excluding the quantity of tin plate exported after being worked up here, and which is to be excluded from the quantity to be considered by the Government authorities in ascertaining the ratio of domestic production to imports, it appears almost positively certain that our manufacturers must be able to show an annual production of at least 100,000 gross tons of tin plate lighter in weight than 63 pounds per 100 square feet by the 1st of October, 1896, if they hope to see the duty retained after that date. This means a very heavy addition to the production of iron and steel sheets, and this addition must be provided for rapidly. We have no means of knowing how great a part of the present sheet output would be immediately available for tinning. Possibly a very small part would meet ordinary requirements, but the quantity cannot be large. But the fact must not be overlooked that for years our sheet production has barely kept pace with the demand for black and galvanized sheets. Obviously the present output is needed for the ordinary requirements of consumers of black and galvanized sheets, and an expansion of that trade is to be looked for unless all signs fail. It seems imperative that special mills will have to be provided for the tin plate trade, and that they must be provided soon. Congress did not mean by fixing the probationary period to end October 1, 1896, that the whole of the intervening period would be spent in gradually building up a tin plate industry. It was expected on all sides that a very good showing would be made by domestic producers much earlier. If they hope to keep public sentiment in their favor they must earn it by the most vigorous efforts to establish this new industry on the broadest footing in the least time possible.

The scarcity of cars in the Northwest has latterly developed into almost a car famine. Merchants and manufacturers are pouring numerous complaints into the railroad companies, but can obtain no relief. Every spring and fall witnesses a scarity of cars of some intensity, but the present demand for rolling stock exceeds anything previously known in this respect. The pressure for more cars began considerably earlier than usual, owing to the decided activity in general trade, and when grain, coal, lumber and stocks of goods for the fall trade commenced to move there was such a heavy volume of business precipitated on the railroad lines that their facilities proved wholly inadequate to the demand. Consumers of iron feel the shortage of cars very keenly, as they are not carrying heavy stocks at present, depending on reasonably prompt deliveries under existing contracts. When the railroad lines adopted the demurrage system, and its strict enforcement became common among them, it was supposed that the prompt return of cars into service would afford much relief. But the growth of railroad traffic has been much more rapid than the railroad authorities dreamed it would be, and the car famine exists despite the fact that the National Car Service Managers report that the average detention of cars by consignees has latterly been reduced to but little more than three days. The obvious result of this experience of the railroad companies must be a heavier demand for new cars than ever during the coming year. Prosperity among the car builders means a greatly increased consumption of iron and steel in that direction.

A large party of Philadelphia capitalists will leave on a special train next Saturday to investigate the resources of Kensington, Walker County, Ga., with a view of erecting new enterprises should the location warrant it. Harry S. Fleming, chemist, of Lansdowne, Pa., will accompany the party as consulting expert.

James P. Witherow, the well known engineer and contractor, of Pittsburgh, has returned home after a three months' visit to Europe.

Manufacturers of Iron and Steel Sheets.

In view of the interest now being taken in everything connected with the proposed tin plate industry, the appended list of manufacturers of iron and steel sheets in the United States has been prepared. The information is derived mainly from the American Iron and Steel Association's directory. By way of preface, it is necessary to state that in this list are included all works, except crucible steel works, making sheets of any kind and in any quantity. Crucible steel works are omitted because the sheets they turn out are of a wholly different class from the sheet iron of commerce, and therefore should not be considered with it. There are not many works in this list which make a specialty of light sheets. Pains have been taken to indicate works of this character by appropriate designations. The list is arranged geographically rather than alphabetically.

NEW YORK.

Troy Steel and Iron Company, Troy. Make steel sheets as an incident of a varied product.

NEW JERSEY.

American Sheet Iron Company, Phillipsburg. Make iron sheets solely.

Columbia Rolling Mill Company, Jersey City. Make taggers iron from tin plate scrap.

PENNSYLVANIA.

Eastern Works. — Penn Treaty Iron Works, Marshall Brothers & Co., Philadelphia. Make iron sheets and plates.

Conshohocken, Pennsylvania and Corliss Iron Works, J. Wood & Brothers Company, Conshohocken. Make iron sheets and plates.

Easton Sheet Iron Works, Theodore Oliver, Easton. Iron sheets are the exclusive product.

Schuylkill Iron Works, Alan Wood Company, Conshohocken. Make iron and steel plates and sheets.

Plymouth Rolling Mill, Conshohocken. Equipped to make iron and steel plates and sheets, but idle at present.

Viaduct Iron Works, Coatesville Rolling Mill Company, Coatesville. Make iron and steel sheets exclusively.

Western Works.—American Iron and Steel Works, Jones & Laughlins, Limited, Pittsburgh. Make sheets as part of a varied product.

Apollo Iron and Steel Company, Apollo. Make iron and steel sheets exclusively.

Apollo Sheet Iron Works, P. H. Laufman & Co., Limited, Apollo. Make iron and steel sheets and terne plates.

Arethusa Iron Works, George W. Johnson, New Castle. Iron plates and sheets are the sole product.

A. M. Byers & Co., Pittsburgh. Make iron sheets as a partial product and not a specialty.

Canonsburg Iron and Steel Company, Canonsburg. Make iron and steel plates solely.

Chartiers Iron and Steel Company, Limited, Pittburgh. Make iron and steel sheets solely.

Clinton Iron and Steel Company, Pittsburgh. Make iron and steel sheets as a partial product.

Juniata Iron and Steel Works, Shoenberger & Co., Pittsburgh. Make iron and steel sheets as a partial product

Kensington Iron Works, H. Lloyd, Son & Co., Pittsburgh. Make iron sheets in connection with other products.

Leechburg Iron Works, Kirkpatrick & Co., Limited, Leechburgh. Make iron and steel sheets solely.

Linden Steel Company, Limited, Pittsburgh. Make steel sheets as a partial product.

Republic Iron Works, Pittsburgh. Make iron plates and sheets.

McKeesport Iron Works, W. Dewees Wood Company, McKeesport. Make iron sheets solely.

Scottdale Iron and Steel Company, Limited, Scottdale. Make iron sheets solely.

Sharon Iron Company, Sharon. Make iron sheets as a partial product.

Sligo Rolling Mills, Phillips, Nimick & Co., Pittsburgh. Make iron sheets as a partial product.

Soho Iron Mills, Moorhead-McCleane Company, Pittsburgh. Make iron and steel plates and sheets.

United States Iron and Tin Plate Company, Limited, Pittsburgh. Make iron and steel plates and sheets and have already begun to make tin plate.

Vesuvius Iron and Nail Works, Moorhead, Brother & Co., Pittsburgh. Make iron sheets as a partial product.

West Penn Steel Works, Jennings Bros. & Co., Limited, Leechburg. Make steel plates and sheets.

DELAWARE.

Delaware Iron Works, Alan Wood Company, Wooddale. Make iron sheets solely.

Marshallton Iron Works (Incorporated), Marshallton. Make iron sheets solely.

Minquas Iron Works, McCullough Iron Company, Wilmington. Make iron sheets solely

Newport Rolling Mills, Marshall Iron Company, Newport. Make iron and steel sheets solely.

MARYLAND.

McCullough Iron Company, Northeast, Elkton and Rowlandville. Make iron and steel sheets solely.

VIRGINIA.

Iron Gate Iron and Steel Company, Iron Gate. Make iron and steel sheets as a partial product.

WEST VIRGINIA.

Crescent Iron Works, Whitaker Iron Company, Wheeling. Make iron sheets solely.

Wheeling Iron and Nail Company, Wheeling. Make iron sheets as a partial product.

KENTUCKY.

Anchor Iron and Steel Works, L. M. Dayton, Newport. Iron sheets are made as part of a varied product.

Ewald Iron Company, Tennessee Rolling Works and Louisville. Make iron and steel sheets as a partial product.

Licking Rolling Mill Company, Covington. Make iron sheets as a partial product.

Mitchell, Tranter & Co., Covington. Make iron and steel sheets as a partial product.

Newport Iron and Steel Works, Newport. Built to make iron and steel sheets as a partial product, but idle at present.

ALABAMA.

Bessemer Rolling Mills, Bessemer. Make iron sheets as a partial product.

Birmingham Rolling Mill Company, Birmingham. Make iron sheets as a partial product.

OHIO.

Ætna Iron and Steel Company, Bridgeport. Make iron and steel sheets as a partial product.

Britton Iron and Steel Company, Cleveland. Make iron and steel sheets as a partial product.

Cambridge Iron and Steel Company, Cambridge. Make iron and steel sheets solely.

Cincinnati Corrugating Company, Piqua. Make iron and steel sheets solely.

Cincinnati Iron and Steel Company, Cincinnati. Make iron and steel sheets as a partial product.

Cleveland Rolling Mills Company, Cleveland. Make iron and steel sheets as part of a varied product.

Falcon Iron and Nail Company, Niles. Make iron sheets as a specialty.

Globe Rolling Mill Company, Cincinnati. Make iron sheets as a partial product.

Haselton Iron Works, the Andrews Bros. Company, Youngstown. Make iron and steel sheets as a partial product.

Irondale Rolling Mill, Wallace, Banfield & Co., Limited, Irondale. Make iron and steel sheets solely.

Ironton Rolling Mill, New York and Ohio Iron and Steel Company, Ironton. Make iron sheets as a partial product.

Mahoning Iron Works, Bonnell & Co., Youngstown. Make iron sheets as a partial product.

Mahoning Valley Works, Mahoning Valley Iron Company, Youngstown. Make iron sheets as a partial product.

Maumee Rolling Mill Company, Toledo. Make iron and steel sheets as a partial product.

New Philadelphia Iron and Steel Company, New Philadelphia. Make iron and steel sheets as a partial product.

Niles Rolling Mill, Coleman, Shields & Co., Niles. Iron sheets are a partial product.

Portsmouth Iron and Steel Works, Portsmouth. Equipped to make iron and steel sheets with other product.

Russia Mill, Joshua S. Ingalls & Co., Troy. The exclusive product is Craig polished sheet steel.

Standard Iron Company, Bridgeport. Make iron and steel plates and sheets.

Summers Iron Works, Summers Brothers & Co., Struthers. Make iron sheets solely.

Wellsville Plate and Sheet Iron Company, Wellsville. Make iron and steel plates and sheets.

INDIANA.

Iron Dale Steel and Iron Company, Anderson. Make iron and steel plates and sheets.

MISSOURI.

Granite Iron Rolling Mills, St. Louis Stamping Company. Make iron and steel sheets solely.

Laclede Rolling Mills, Chouteau, Harrison and Vallé Iron Company, St. Louis. Equipped to roll iron and steel sheets with other products.

Union Steel and Iron Company, St. Joseph. Make iron and steel sheets as a partial product.

In addition to the above enumerated works the Springfield Iron Company, of Springfield, Ill., have a plant for rolling steel sheets, but as it has not been operated for several years it is hardly entitled to be counted. A recapitulation of the works named gives us the following numerical table:

States.	Works.
New York	1
New Jersey	2
Pensylvania	27
Delaware	4
Maryland	1
Virginia	1
West Virginia	2
Kentucky	5
Alabama	2
Ohio	21
Indiana	1
Missouri	3
Total	70

Quite a number of the works which are named in the foregoing list market their sheet product in other forms than plain black sheets. They manufacture galvanized iron, corrugated sheets for roofing and siding, domestic utensils, &c.

An enterprise in the sheet steel line which is attracting much attention is the Norton direct process for rolling sheets from molten metal, which will be put in practical operation very shortly. The Norton Fluid Metal Rolling Company are completing a plant for this purpose at Maywood, Ill., having most of the machinery now in place. They will make steel sheets expressly for tin plate, a tinning department forming part of the enterprise. Their purpose is first to make tin plate for their own consumption, the members of the company being proprietors of extensive can factories. The process has been successfully demonstrated in an experimental way, and if it proves to be equally successful on a commercial scale it will revolutionize the manufacture of sheet metal.

Washington News.

(From Our Regular Correspondent.)

WASHINGTON, D. C., October 7, 1890.

The Secretary of the Navy, after the opening of the bids for the three battle ships and triple screw protected cruiser, complimented the bidders and the country upon the important realizations of that day when it was shown to the world that the private shipyards of the United States were capable of turning out the most formidable war craft afloat. This, he said, was the creation of a single decade, and practically demonstrates that the rebuilding of the navy on modern plans and of modern material, besides being judicious as a precaution against war, has been of incalculable advantage to the steel industries.

As a matter of interest to the metallurgical world, we submit the official transcript of the bids for nearly $15,000,000 of steel war ships.

Proposals for the Construction of Coast Line Battle Ships.

Union Iron Works, San Francisco, Cal., for hull and machinery, Department plans—for No. 1 of said vessels $3,240,000
For No. 2 of said vessels ($3,200,000 each) 6,400,000
Certified check, $150,000.

Risdon Iron and Locomotive Works, San Francisco, Cal. (Department plans) 3,275,000
Certified check for $100,000.

William Cramp & Sons, Ship and Engine Building Co., Philadelphia, Pa. (Department plans), for one of said vessels 2,990,000
For two of said vessels ($2,890,000 each 5,780,000

The same company—for one vessel in accordance with plans of bidder 3,720,000
For two of said vessels ($3,020,000 each) 6,040,000
Certified checks, this and above, for $150,000.

The same company (Department plans), for the third of said vessels 2,990,000
Certified check, $50,000.

The same company (bidder's plans), for the third of said vessels 3,120,000
Certified check, $50,000.

Bath Iron Works, Bath, Maine (Department plans), for one of said vessels 3,149,000
Certified check, $100,000.

Proposals for Protected Cruiser of about 7350 tons displacement (Cruiser No. 12), opened October 1, 1890.

William Cramp & Sons, Ship and Engine Building Company, Philadelphia, for hull and machinery, including engines, boilers and appurtenances, complete in all respects in accordance with the plans and specifications provided by the Secretary of the Navy $2,725,000

Union Iron Works, San Francisco, Cal. 3,025,000
Certified check, $50,000.

The Secretary of the Navy, in consultation with Chief Constructor Wilson, Engineer in Chief Melville and the Judge Advocate General, carefully looked into the whole question of the bids. He has notified William E. Cramp & Sons, of Philadelphia, of the award to them of the contract for the construction of two coast line battle ships, increased in length 12 feet over the Department plans, for $3,020,000 each, and the contract for the

triple screw protected cruiser under Department plans at their bid, $2,725,000.

The Union Iron Works, of San Francisco, Cal., have also been notified of the award of the contract for the construction of one of the battle ships on the same plans of the other two at $3,180,000, the amount of the Cramp bid for one vessel, with an addition of $60,000 for transportation expenses. Their bid was $3,240,000, therefore the amount of the award is $60,000 less than their bid. If they should decline to accept the figure, the Cramps will build the whole of the fleet.

The Cramps is the largest contract ever given to a single firm in the United States, the amount aggregating $8,765,000.

These vessels should be afloat by 1893. When finished the United States will have a modern navy consisting of 15 armored ships, five of which will be of the battle type, and 31 armored steel high speed vessels, making a fleet of 46 first-class vessels of the latest construction, material and armament.

The governments of the world rank as follows:

	Armored.	Unarmored.
England	76	291
France	57	203
Russia	49	119
Germany	40	65

The governments of Holland, Spain, Italy, Turkey, China, Sweden, Norway and Austria are still ahead of the United States in numerical force, but the American ships are the superiors of those of the nations named in all the qualities of formidable engines of war in material, design, armament and handling.

The question of bids for three steam tugs, which has given the Department so much trouble, was solved yesterday by the bids of Harrison Loring, of South Boston, who put in bids for $32,438 each. J. H. Dialogue, of Wilmington, Del., bid for $33,300. The Department plans were altered before any bidders could be secured. The first attempt was made nearly two years ago. The steel inspection at the Navy Department proposed for to-day has been put off until the 16th inst.

Bar Iron Extras.

An adjourned meeting of the conference of Bar Iron manufacturers was held in Philadelphia, October 3, at the rooms of the American Iron and Steel Association, with a large representation of Eastern mills. Oliver Williams, of Catasauqua, Pa., occupied the chair and William E. S. Baker acted as secretary. After discussion in regard to the matter, the schedule of extras and terms of sale, which are printed below, were adopted as reported by the committee, to take immediate effect. The secretary was requested to send copies to the Bar Iron manufacturers of the country, and solicit their co-operation in having it adopted as a uniform list. We print below the schedule of extras, from which it will be seen that it is practically the same as the Western list, with such additions and modifications as will adapt it to general use:

SCHEDULE OF MINIMUM EXTRA PRICES ABOVE THE BASE BAR PRICE TO BE CHARGED FOR EXTRA SIZES OF IRON.

Base Sizes.—Not Extra.

Round and square Iron.. ..... 1 to 17/8 inches.
Flat Iron. ..... .1¼ to 4 x 3/8 to 1 inch.

Extra Sizes.—Round and Square.

	Cts. per lb. extra.
1 to 1⅞ inches, ○ and □ base	No extra.
15-16 to ¾ " " "	1 10
11-16 to 9-16 " " "	2-10
½ to 7-16 " " "	4-10
⅜ " " "	6-10
5-16 " " "	8-10
¼ " " "	1
3-16 " " "	3
2 to 2¾ " " "	2-10
2¾ to 3¼ " " "	5-10
3⅜ to 4 " " "	1
4¼ to 5 " ○ only, "	1 5-10
5¼ to 5½ " " "	2
5⅝ to 6 " " "	2 3-10
6¼ to 6½ " " "	2 5-10
6⅝ to 7 " " "	2 7-10

Extra Sizes, Flats.

	Cts. per lb. extra.
1¼ to 4 x ⅜ to 1 inch	1-10
4¼ to 6 x ⅜ to 1 "	2-10
4¼ to 6 x ¼ to 5-16 inch	2-10
1½ to 4 x ¼ to 5-16 "	4-10
1¾ to 6 x 1⅛ to 1¼ "	1-10
1¼ to 1⅝ x ⅜ to 1 inch	1-10
1 to 1½ x ⅜ to 1 inch	2-10
1 to 1⅝ x ¼ to 5-16 inch	3-10
1 x 3-16 inch	5-10
⅞ x ⅜ to ⅝ inch	4-10
⅞ x ¼ to 5-16 inch	6-10
⅞ x 3-16 inch	7-10
¾ x ½ to ⅝ inch	5-10
¾ x 1¼ to 5-16 inch	7-10
¾ x 3-16 inch	1
⅝ x ⅜ to ½ inch	7-10
⅝ x ¼ to 5-16 inch	1
⅝ x 3-16 inch	1 4-10
½ x ¼ to ⅜ inch	1 2-10
½ x 3-16 inch	1 8-10

Extra Sizes.—Large Flats.

	Cts. per lb. extra.
2 to 4 x 1⅝ to 2 inch	4-10
2 to 4 x 2⅛ to 3 "	5-10
4¼ to 6 x 1⅝ to 2 "	6 10
4¼ to 6 x 2⅛ to 3 "	1
7 x ⅜ to 1 inch	8-10
7 x ¼ and 5-16 inch	1
7 x 1⅛ to 2 inch	1
8, 9, 10, 11 and 12 x ⅜ to 1 inch.	1
" " ¼ to 5-16 "	1 2-10
" " 1⅛ to 2 inch	1 2-10

Hoop and Band Iron. Cents Per Pound Extra.

Thickness. Nos.	9 to 3-16	12 to ⅛	13 to 15	16	17 & 18	19	20	21	22	23
1½ to 6 inches..	4-10	5-10	.....	.....	.....	.....	.....	.....	.....	.....
1 7-16 to 4 " ..	4-10	5-10	6-10	7-10	.....	.....	.....	.....	.....	.....
1 7-16 to 2 " ..	4-10	5-10	6-10	7-10	7-10	8-10	9-10	1 1-10	1 4-10	.....
1⅛ to 1⅜ " ..	5-10	6-10	7-10	8-10	8-10	1c.	1c.	1 2-10	1 5-10	.....
1 inch.....	5-10	6-10	8-10	9-10	9-10	1 2-10	1 2-10	1 4-10	1 6-10	.....
15-16 " ..	5-10	6-10	8-10	9-10	9-10	1 2-10	1 2-10	1 4-10	1 6-10	.....
⅞ " ..	7-10	8-10	1 2-10	1 4-10	1 4-10	1 5-10	1 5-10	1 7-10	1 8-10	.....
13-16 " ..	7-10	8-10	1 3-10	1 5-10	1 5-10	1 6-10	1 6-10	1 8-10	2c.	.....
¾ "	1c.	1 2-10	1 4-10	1 7-10	1 7-10	1 9-10	1 9-10	2 1-10	2 3-10	.....
11-16 " ..	1c.	1 2-10	1 9-10	2c.	2c.	2 2-10	2 2-10	2 4-10	2 6-10	2 8-10
⅝ " ..	1 4-10	1 6-10	2c.	2 2-10	2 2-10	2 4-10	2 4-10	2 6-10	2 8-10	3c.
9-16 " ..	1 4-10	1 6-10	2 4-10	2 6-10	2 6-10	2 8-10	2 8-10	3c.	3 2-10	3 4-10
½ "	1 8-10	2c.	2 8-10	3c.	3c	3 2-10	3 2-10	3 4-10	3 6-10	3 8-10

Wagon Box, Beveled Edge and Hame Back Shapes same prices as Bands of same thickness and width.

Oval Iron.

	Cents per lb. extra.
⅞ to 2 inches	4-10
¾ to ⅝ inch	6-10
9-16 and ½ inch	8-10
7-16 and ⅜ "	1 2-10

Half Oval and Half Round.

⅞ to 2 inches	7-10
¾ to ⅝ inch	1 2-10
9-16 and ½ inch	1 5-10
7-16 and ⅜ "	3

Light Half Oval.

Nos. 10 to 13 same prices as Bands of same width and thickness.

Horseshoe Iron.

All sizes ..... 1c. per lb.

Additional Charges.

	Cts. per lb.
Cutting Bars, Rods, &c., to special lengths	2-10
Cutting Bands and Hoops to special lengths	1-10
For each guage lighter than indicated on list	1-10
Stone and Marble Saw Blades	3-10

TERMS AND AGREEMENT.

Payments.—Net cash, 30 days.
Deliveries.—F.O.B. cars or boat at mill.
Freights.—If rates are allowed or guaranteed to destination, no responsibility will be incurred for delays in transit or damage by railroads or vessels.
Agreements.—Are contingent upon strikes or other delays unavoidable or beyond our control.
Prices.—Subject to change without notice.
Claims.—Quality and finish, if not as represented, to be replaced at manufacturer's expense, but no claims allowed for labor or damage.

Joseph T. Ryerson & Son, of Chicago, jobbers of iron and steel plates and sheets, have issued their stock sheet for October, showing the sizes and number of each now on hand. Glancing over this publication the reader cannot help observing that the usually large stock of this prominent house has been considerably depleted by the heavy demand recently experienced for plates and sheets, together with the inability of mills to make prompt deliveries.

Lake Shipbuilding.

A comparison made by the *Marine Review* between the output of the ship yards on the Clyde, the shipbuilding center of Great Britain, and on the lakes in this country gives the American public a fresh conception of the magnitude and importance of the lake commerce. During the month of July 15 steamers, three sailing vessels and five yachts, with a tonnage measurement of 16,765 tons, were launched on the Clyde, while 14 vessels, with a tonnage of 15,668, were launched on the lakes. This does not include the Monarch, estimated at 2000 tons, launched on the Canadian side, making the output of lake shipyards for July 17,668 tons, pretty nearly 1000 tons more tonnage than was built on the Clyde, and in comparing numbers it is seen that the lakes turned out larger vessels. During July the new orders on the Clyde aggregated 8000 tons in round numbers; the orders placed during that month on the lakes figured 18,000 tons. No other shipbuilding region in the world can show as much business as the lakes for that month.

The following table, showing the shipbuilding productions of the world, has been published recently:

	1888 No. vessels.	1888 Tonnage.	1889 No. vessels.	1889 Tonnage.
United Kingdom.	484	776,993	656	1,180,349
United States.	132	139,148	171	209,582
Germany	37	39,994	79	101,984
France	14	10,721	22	42,921
British Colonies.	68	17,106	75	27,368
Denmark	5	5,721	20	15,0.6
Norway	19	11,433	32	14,640
Netherlands	3	5,156	10	11,033
Italy	8	1,789	21	7,862
Sweden	15	4,088	25	7,084
Greece	15	3,086	17	4,319
Austria	5	5,038	6	1,835
Russia	7	1,713	7	1,830
Other Countries.	12	5,478	5	1,531
Totals	824	967,473	1,146	1,627,381

It will be seen that in spite of the decadence of American shipping the United States still ranks second among the shipbuilding nations, and the dwellers by the great lakes will note with pardonable pride the fact that this distinction is owing to the flourishing condition of the lake marine. In 1888 the new tonnage launched on the lakes amounted to nearly three times the total new tonnage of the seaboard, and in 1889 to twice the ocean tonnage. The publication and circulation of comparisons like these will do much to awaken the people of the United States and their representatives at Washington to a realizing sense of the proportions and just claims of what has grown to be by far the greatest shipping interest of this country.

NEW PUBLICATIONS.

POOR'S MANUAL OF RAILROADS, 1890; twenty-third annual number; by H. V. & H. W. Poor; 8vo.; cloth; pp. 1424.

This well known publication is now quite essential to every large business and banking house and editorial room. There are also statements of bond obligations, their securities and trustees, and also a new and valuable feature in special and accurate maps of 51 leading railways of the country. These show the territory covered, in its topographical features, and the railroads traversing it. Taken with conjoined statements of the corporations and their various branches, they give the inquirer exact and clear information difficult to obtain from general maps. The capital of American railroads which earned revenue in 1889 is $9,361,000,000. The total investment was $9,680,942,249. Their gross earnings were $1,003,736,596, or 10.4 per cent. on investment. Their net earnings were $322,284,986, or 3.3 per cent. on the capital. At the close of the fiscal year 1889, there were 161,396.64 miles of track laid, and 160,544.24 miles completed, showing as an increase of mileage 6,268.43 miles for 1889. The freight tonnage in 1889 was 619,137,237 tons. The average haul was 110.80 miles, or 68,604,012,396 tons were hauled 1 mile. The rate of freight transportation has decreased since 1882 from 1.236 to less than 1 cent per mile. Passenger transportation has increased in number in one year from 3018 to 3054.7 per mile. The facilities of railroad transportation have been increased far above the actual passenger travel per mile.

Of the entire railroad mileage about one fifth, or 33,500 miles, have been completed the last four years—from 1886 to 1889. The section of country which has profited most from this remarkable increase has been the Northwest. There the all-rail route to the East, via Sault Ste. Marie, has been completed, and lines built to ports on Lake Superior and Lake Michigan. Superior advantages have thus been gained over the old route from the Pacific, via Chicago.

The Canadian Pacific Railway Company have been the principal factor in this construction. They have built short routes across Northern Maine, connecting the Western and Eastern Canadian provinces. By an important extension to Detroit, through Canada, they compete for the trunk line traffic from Chicago to the East.

The Northwest has also witnessed the building of the Wisconsin Central and three lines between Kansas City to Chicago. Corresponding to this improvement has been the construction of the Pan Handle route, in Texas, to give Denver and Colorado a cheap seaboard route, via Galveston and ocean steamers. There has also been a vigorous pushing of the Atchison, Topeka and Santa Fé and St. Louis and San Francisco routes, across the Indian Territory into Texas, toward a deep water harbor, which will secure a heavy traffic.

In the South there has been an effort to develop by new roads the mineral and timber regions. In new England a route has been built via the Poughkeepsie Bridge, on the Hudson, from the Pennsylvania coal fields to Hartford, Conn. The longest line constructed during the four years named has been the St. Paul, Minneapolis and Manitoba, of the Great Northern system, to Butte, Mon. Kansas and Nebraska have gained a network of railroads from the competition for the traffic of these States, by the Santa Fé, Missouri and Pacific, Rock Island, Chicago, Burlington and Quincy, Union Pacific and Chicago and Northwestern Railway's systems. The investment in these 33,000 miles of railroad have been generally profitable. The returns have prevented the usual depression or financial panic from such extensive railroad building, and general prosperity has been promoted by it.

POOR'S HANDBOOK OF INVESTMENT SECURITIES, July, 1890. New York, H. V. & H. W. Poor, publishers; 8vo, pp. 305. Paper, $1.50; cloth, $2.50.

This is a supplement to Poor's "Manual of Railroads," which relieves that publication of too great bulk for a manual, and gives the fullest and most minute information of the financial standing and history of the securities which should interest investors. The list of bond coupons, range of stock and bond values for 12½ years, dividends for eight years, bonds and securities listed on the New York Stock Exchange from January 1, 1879, to June 30, 1890, constitute the most valuable divisions of this volume. It is a complete financial directory to a banking house or investor. The labor involved in the accumulation of these concrete facts in figures is a worthy consideration of its value to those who can profitably use them and avoid the toil of personal inspection of reports.

Horace M. Peck died at his residence in Providence, R. I., October 1, at the advanced age of 84 years. In the death of this gentleman the city, especially the mechanical industry, loses one of its most earnest and praiseworthy workers. He was born at Swansea, Mass., July 10, 1806, and, having spent his boyhood at the cabinetmakers' trade with his father, came to Providence in 1827 and entered the employ of the Phœnix Iron Foundry on October 1, 1830. Thus, with the exception of two months, he had spent 60 years in active labor and in connection with one concern. During this time he made the study and construction of gearing his special work. It had always been Mr. Peck's earnest desire to complete fully his sixtieth year with the company with which he had grown up, and which owes so much to him for its prosperity, but failing health made it necessary for him to retire in July, and his death occurred on the day and almost the very hour when his three times twenty years at the bench would have been filled out. He leaves a widow and four children.

The fifty-ninth annual exhibition of the American Institute opened at the Institute Hall, Third avenue and Sixty-third street, New York, on Wednesday night, October 1. John O. Chatillon presided, and the opening speech was made by Gen. E. E. Bullard, of Saratoga. A large number of visitors were present at the opening, and though all the displays are not yet completed, there is every indication that the exhibition will be as successful as during previous years. A noticeable improvement in the show is in the electrical department, which is a more prominent feature than heretofore.

G. A. Crosby & Co., 176 South Clinton street, Chicago, had a narrow escape from being burned out last week by the burning of a large building adjoining their works in the rear. As it was they sustained a loss of about $500 through charred window frames, broken skylights, window glass and water. The heat was so intense that panes of glass melted in the frames and ran together in most peculiar shapes. They have a great deal of special machinery in the wing of the building where the greatest damage occurred, but as none of it was injured their business was not interrupted. In the same department is also a large line of new machinery for an incomplete order, and if the fire had gained a little more headway the loss would have been very heavy.

SOUTHERN MISCELLANY.

The rolling mill, steel plant, machinery, &c., of the Crown & Cumberland Steel Company, at Cumberland, Md., has been sold to T. A. Hicks, W. C. Dickey and R. B. Sidell, of Philadelphia, Pa. The amount paid for the property is reported to be $42,000.

The Peek iron property, consisting of 750 acres and situated near Cedartown, Ga., has been purchased by the Cedartown Land and Improvement Company, who were recently organized.

The King John Furnace of the De Bardeleben Coal and Iron Company, Birmingham, Ala., was blown in recently. This company are reported to have purchased recently the Frog Mountain iron ore property, near Piedmont, Ala., which they intend developing at once. The amount paid for the property was $100,000.

A party of engineers prospecting for coal for the Tennessee Coal, Iron and Railroad Company, 20 miles west of Birmingham, struck natural gas one day last week. A hole had been bored to a considerable depth when a strong volume of gas burst forth. It was ignited and burned freely. It is thought that the find is a valuable one.

The Chattanooga Railway Supply Company, with $50,000 capital stock, are reported incorporated at Chattanooga, Tenn., for the purpose of erecting a foundry for the manufacture of railroad frogs, switches and other railroad supplies.

The Chattanooga Company, of Chattanooga, Tenn., are now enlarging their plant to double its former capacity. The addition of an iron foundry is contemplated when the present improvements are completed.

A movement is on foot in Birmingham, Ala., looking to the organization of a company to establish a cotton tie works in that city.

At Parkersburg, W. Va., a company has recently been formed to erect and operate a plant for the manufacture of steel wire nails by the Hastings patent.

McNamara & Brother, at Tecumseh, Ala., are opening iron mines near that town, and Minor & Co., of Lakeview, Ala., are developing iron properties on Red Mountain. In addition the Messrs. Yourtier, of St. Louis, Mo., are reported to be developing the ore deposits that lie on the Birmingham, Sheffield and Tennessee River Railroad. They are preparing to put in a plant with a daily capacity of 300 tons.

Machine shops that are to cost $1,000,000 will be erected at Fort Worth, Texas, by the Union Pacific Railway Company.

The East Tennessee, Virginia and Georgia Railroad Company intend erecting machine shops at Brunswick, Ga.

A movement is on foot at Vernon, Texas, looking to the organization of a company for the purpose of erecting and operating a machine shops and iron foundry.

The Rollstone Machine Company, of Anniston, Ala., have decided to erect a molding department, which will give employment to about 30 men.

A car spring manufactory is being established at Oxanna, Ala., the southern suburb of Anniston.

Eastern capitalists are reported to be negotiating at Baltimore, Md., looking to the establishment near that city of extensive car and car wheel works.

J. T. Hill, manager of the coal mines of the Sloss Iron and Steel Company, of Coalburg, Ala., writes that in the report of the coke ovens in the Birmingham district, published in *The Iron Age* of September 18, the Gamble Coal and Coke Company should be credited with 300 coke ovens, instead of 250, given in the table first furnished by him, making the number of coke ovens in operation in that district 4607, instead of 4557.

The Wells Rustless Iron Company, 52 John street, New York, have lately oxidized 7500 feet of 4-inch tubes, and are now about to treat 18,000 feet of 2-inch tubes for condensers.

India has 16,000 miles of railway, of which 869 were added last year, mostly owned by the Government.

MANUFACTURING.

Iron and Steel.

In all probability the United States Iron and Tin Plate Company, Limited, of Demmler, Pa., will soon engage in the manufacture of tin and terne plates. The company equipped their plant several years ago for the manufacture of tinned plates, but on account of the absence of a sufficient tariff the works were reconstructed for the manufacture of sheet iron.

The Lehigh Valley Spike Works, of Allentown, Pa., have received a large contract from the Philadelphia and Reading Railroad Company. It calls for 100,000 pounds of standard spikes, 744 barrels, and will keep the employees busy several months.

At a meeting of representatives of the firm of Carnegie, Phipps & Co., Limited, proprietors of the Homestead Steel Works, at Homestead, and William Weihe and Edward Keil, representing the Amalgamated Association of Iron and Steel Workers, held on Monday, the 29th ult., the wage base for the next three months, commencing October 1, was arranged. It was found that the average selling price for 4 x 4 steel billets during the three months ending September 30, was $29.75, and the wages for the three months will be computed on those figures. This will give the employees an increase of 5⅛ per cent. over the wages of the past quarter.

The Stewart Iron Company, Limited, of Sharon, Pa., have purchased from the McClure Coke Company, of Pittsburgh, 100 acres of the coal underlying the Colonel Evan's farm in North Union Township, Fayette County, Pa. The price paid was $400 per acre.

At the Sable Iron and Nail Works of Zug & Co., Limited, at Pittsburgh, two new puddling furnaces that were built during the summer have just been put in operation. Two more are being erected, and when completed will make a total of 42 puddling furnaces in the above plant.

Isabella Furnace (charcoal) of Joseph D. Potts, located at Barneston, Pa., which was burned down in January last, has been rebuilt of solid stone, with iron girders and iron roof, making it thoroughly fire proof. It will be put in blast in the early part of November.

The Pittsburgh Malleable Iron Company, of Pittsburgh, have been granted a charter, with a capital stock of $25,000. The directors are Frank Moore, J. R. McGinley, George Rollings, T. W. Seiman and T. B. Atterbury, Jr., all of Pittsburgh.

The blast furnace of the Bellaire Nail Works, at Bellaire, Ohio, is making an excellent record. On Saturday, the 27th ult., its output was 249 tons, and the output for the week ending with the above date was 1398 tons of first-class Bessemer iron. The steel plant of this firm is also doing good work. In one day recently the output was 377 tons of finisbed steel. All departments of the plant are being operated full time, except the nail factory which is idle. The above firm uses on an average 11,000 bushels of coal every two weeks, at an average of 3½ to 4 cents per bushel.

The plate department of the plant of the Jefferson Iron Works, at Steubenville, Ohio, which was destroyed by fire a few weeks ago, will be ready for operation in a few days. Work has commenced on the rebuilding of the nail factory destroyed at the same time.

An important meeting of the stockholders of the Ætna Iron and Steel Company, of Bridgeport, Ohio, was held on Tuesday, the 30th ult., at which it was voted to increase the capital stock from $302,000 to $500,000. A resolution was also adopted ordering that a stock dividend of $198,000 be declared out of the surplus of the company. The increase in stock is about 65 per cent., and there still remains about $100,000 in the surplus fund. At this meeting the stockholders were notified that the deal with the English syndicate, at one time thought to be near consummation, was entirely off, and the plant will continue to be operated by its present owners.

Robert H. Coleman, proprietor of the Colebrook, Cornwall, Anthracite and Lochiel Furnaces, at Lebanon, Pa., has appointed H. T. Richards superintendent of the two Cornwall anthracite furnaces and Sterling G. Valentine superintendent of the two Colebrook furnaces. Col. C. W. Eckman will continue to superintend the Lochiel Furnace, at Harrisburg. Robert H. Coleman will assume the the management of all of the above furnaces.

A disastrous explosion occurred at the works of the Clinton Iron Company, Pittsburgh, recently, causing great damage, but fortunately no loss of life. The large air chamber known as the air receiver in connection with the blast furnace exploded, lifting the roof off the engine house and badly shaking the building and scattering the brick walls in all directions. The loss will reach $10,000, and it will be some time before the furnace can be blown.

The Kensington Iron and Steel Works, Philadelphia, were sold at public auction recently for $68,000. The plant was bid in by James Roland, who is thought to be acting for a syndicate of creditors.

The plant of the Wrought Iron Casting Company, at Neponset, Mass., was recently destroyed by fire. Loss $15,000; insured

The Empire Iron Company, with a capital stock of $200,000, have filed articles of incorporation at Duluth, Minn.

The property of the California Iron and Steel Company, located at Emery Station, Oakland, Cal., is still on the market. The property consists of a large manufacturing plant and 8200 acres in Placer and Nevada counties.

The Midvale Steel Company, of Nicetown, Pa., will erect a new casting shop 185 x 62 feet, with two wings of 50 feet each. The Berlin Iron Bridge Company, of East Berlin, Conn., have secured the contract for building the shop, which will be entirely of iron and provided with traveling cranes of 50 tons capacity.

The manufacture of bomb shells for the Government is contemplated by the Sterling Steel Company, of McKeesport, Pa.

The two blast furnaces on Breaker Island, owned and operated by the Troy (N. Y.) Steel and Iron Company, have been closed on account of the lining having burned out. It will take six months to clean them out and reline them.

Walter Crafts, general manager of the Woodstock Iron Company, Anniston, Ala., is authority for the statement that the two Woodstock coke furnaces will shortly blow out. The state of the iron trade is given as a reason for this move. While idle arrangements will be made for securing a cheaper supply of raw material.

Star Furnace, at Jackson, Ohio, of which L. V. Brown is manager, recently completed the largest blast ever made in the Hanging Rock region. The furnace blew in January 27, 1886, and was in continuous operation until August 14 of this year.

After an idleness of nearly three years, the Continental Tube Works, of Pittsburgh, Pa., are about to resume under new management. A party of Eastern capitalists, headed by T. B. Everson, of Pittsburgh, a former stockholder and manager of the old company, will operate the plant.

The Watts Steel and Iron Syndicate, Limited, of Middlesborough, Ky., have, it is stated, contracted for seven 25-ton furnaces, but work will not begin on them for another year.

A contract has been made with the Indiana Steel Company, by which the latter will locate their extensive works in Wabash, Ind. The capital stock of the company is $500,000, nearly all held by Pittsburgh capitalists. Wabash gets this industry at an outlay of a subsidy of $35,000 and 20 acres of land. Building is to begin at once, and the works will afford employment for 500 men, the capacity being 50 tons of steel per day, and the pay roll will be not less than $7000 per week.

Greensboro, N. C., has lately received a boom at the hands of several wealthy capitalists, who are said to be spending money liberally in the development of the extensive ore fields lying west of that place. The town is fortunately situated geographically and commercially, having ample railway facilities and being adjacent to ore deposits, which it is believed will at no great future day bring Greensboro prominently forward as an iron producing center. It is the home of the North Carolina Steel and Iron Company, and liberal inducements are being held out to similar enterprises to locate there.

The Slatington Rolling Mill Company, of Slatington, Pa., have completed their rolling mill and begun the production of muck bar. The company report enough orders already booked to keep them busy until November 1, when they will be ready to make merchant iron. William P. Hopkins, formerly connected with the Catasauqua Mfg. Company, of Catasaqua, Pa., is general manager; Dr. A. P. Steckel, president; Joel Neff, treasurer, and S. DeLong, secretary.

Machinery.

The Pennsylvania Machinery Company have been organized at Erie, Pa., for the manufacture of iron bolts, iron nuts, screws and other small articles of iron and steel.

The Totten & Hogg Iron and Steel Foundry Company, of Pittsburgh, have just shipped two sets of iron rolls to Texas to be used as a test in a new patent process for rolling out cotton in sheets or bats and thus compressing it for shipment, thus doing away with the heavy charges for cotton baling. By this simple and inexpensive method a few planters can club together and own a compressor of their own. It is expected that this process, if proved to be a success, will be largely adopted by the cotton growers in the cotton sections of the South, and for this reason the above named firm expect to have a large demand for this class of work.

The Ætna Machine Company of Warren, Ohio, have just closed a contract with the Oliver Iron and Steel Company, of Pittsburgh, for an engine to drive the machinery in the new plant which they are now building in that city.

Work is being pushed rapidly on the new foundry now being erected by the Totten & Hogg Iron and Steel Foundry Company at Pittsburgh. It is to take the place of the one recently destroyed by fire, and will be considerably larger than the old one. The recent fire will not interfere in any way with the filling of orders, which will be continued without interruption.

The Herzog Mfg. Company, of Minneapolis, Minn., manufacturers of architectural and structural iron, have taken out building permits for two large additions to their plant. The larger building will be 90 x 198 feet, two stories high, and will be used for a forge and machine shop, while the other will be 66 x 145 feet, and will be used as a foundry.

William Wright will increase his foundry facilities at Newburg, N. Y., by the erection of an entire new plant. The plans for the structure show that there will be a machine shop 200 x 100 feet, a foundry 160 x 100 feet, and a pattern and blacksmith shop 150 x 50 feet. The site adjoins the West Shore tracks, and the works will be among the most thoroughly equipped in the State.

The Dennis Duplex Machine Company have filed articles of incorporation at Des Moines, Iowa. The capital stock is placed at $500,000.

The business heretofore conducted by the Taylor Gas Producer Company, of Philadelphia, was transferred on October 1 to R. D. Wood & Co., of that city. W. J. Taylor, who was the president of the old company and the inventor of the producer, will retain his interest in its success, and will give it the benefit of his long experience in metallurgy and the use of gas, while the department given up to the manufacture of the producers will be in charge of W. H. Blauvelt, formerly engineer of the Taylor Company. Messrs. Wood & Co. have every facility for the manufacture of producers, and their rapid introduction in industrial establishments is sure to follow.

A new pattern shop, 105 x 40 feet, three stories high, is to be erected at the works of the G. F. Blake Mfg. Company, East Cambridge, Mass. The building will be of brick and will cost about $40,000.

The Marion Machine Works, at Fairmount, W. Va., were recently burned. Loss, $18,000 partly insured.

A new corporation at Columbus, Ohio, is the Minott Electric and Machine Company, whose capital is placed at $50,000.

Hardware.

The Norway Tack Company, of Wheeling, W. Va., have been awarded $39,999 for their property, condemned for a depot for the Wheeling Bridge and Terminal Railroad. They had appealed from the finding of the County Commissioners, which was $48,130.

The Salem Wire Nail Company, of Salem, Ohio, recently turned out 1355 kegs of wire nails in one day's run.

The number of employees in the works of Yale & Towne Mfg. Company, Stamford, Conn., is now over 900, and the list, though it is already larger than at any previous time, will be still further increased in the near future, as soon as facilities now under construction are completed. It is probable that before January 1 the number of employees will exceed 1000. Work on the new pulley block shop is progressing and the contractors hope to complete their part of the work by November 1. A few weeks additional may be required in which to complete the shafting, piping, &c., needed to make the building available for use, after which the business of the pulley block department will be moved and the new building fully utilized. The preparation of plans for new foundry have proved to be a much more serious matter than it at first appeared, and the company have decided to put up temporary sheds, in order to immediately increase their foundry capacity to the extent demanded by present requirements. These will be located on the land south of the main buildings and will be built with all possible dispatch.

The new buildings of the Upson Nut Company, Unionville, Conn., replacing those recently destroyed by fire, are completed, and for the most part in running order. The several departments are in one L-shaped brick building, divided by fireproof partition walls. The finishing rooms, machine shop, shipping rooms and annealing room occupy two floors 141 x 60. The forge shop is 182 x 45 and of fireproof construction. It is equipped with Ærated Fuel Company's system of oil burning and all latest improvements. The oil is stored across the river, where it is received direct from cars and conducted to the factory by pipe line. A tower surmounts the main building, in which are tanks for water supply and fire purposes The plant is supplied with automatic sprinklers for protection from fire and is lighted by electricity throughout. Steam is not required except for heating, water-power being used to run the machinery. The new works are admirably arranged and afford largely increased capacity over the old plant.

Miscellaneous.

The Chicago Wire and Spring Company, 208 and 210 Lake street, Chicago, have purchased from George Kelly & Co. the patents for the United States and Canada covering the manufacture of wire belting and wire matting recently illustrated in our columns. The company are building new machinery for producing these goods. Their factory is at Lockport, Ill., to which they are adding a new one-story frame building, 50 x 75 feet, for the new department, and propose to have it in operation in about two months. The company also make a line of upholsterers' springs and tinned woven wire for mattresses. M. R. Powers is president. S. L. Mershon is secretary and J. T. Nickerson is treasurer.

The Georgia and Alabama Investment and Development Companyhave filed articles of incorporation. The capital stock of the concern is $4,500,000, divided into 450,000 shares at $10 each. The purposes of the company are to purchase, hold and improve real estate and to engage in manufacturing and other industries.

The Schofield Metal Tie Company, of Chattanooga, Tenn., have decided to go ahead with the enterprise and erect works at that place.

The National Metal Edge Box Company, Philadelphia, Pa., finding their present quarters too small for their rapidly increasing business, will remove about November 1 to the large new building now nearing completion on Cherry street. They will occupy the entire building, which will increase both their room and service, placing them in a position to better meet the growing demands of their business.

Alexander, Barney & Chapin have opened spacious salesrooms in the Telephone Building, 20 Cortlandt street, New York. They are fully stocked with all kinds of electrical supplies, some of which they manufacture themselves.

The Page Car Wheel Company, of Cleveland, Ohio, have been using for some time compressed air for the operation of cranes usually manipulated by hydraulic power. They state that the new power is preferable to hydraulic power, and is also economical.

An application has been made for a charter incorporating the Liggett Spring and Axle Company, of Pittsburgh. The incorporators are W. G. Park, T. M. Erwin, J. B. Dodker, Charles E. Clapp and George Wright.

A press dispatch from Wabash, Ind., under date of the 3d inst., says: "The contract between the Wabash Board of Trade and the Indiana Steel Company by which the latter will locate their extensive plant in this city was closed to-day, and the work of erecting the buildings will commence at once. The Indiana Steel Company are a newly incorporated concern, which, with the galvanizing works connected, have a capital of $500,000. Nearly all of the stock is held by Pittsburgh capitalists. The Pittsburgh syndicate proposed to locate in Wabash if given a subsidy in cash of $35,000 and 20 acres of land. Every penny is now provided for. The new plant will be located near the crossing on the Wabash and Cincinnati, Wabash and Michigan roads, in the western part of the city, and will afford employment for 500 men. The capacity will be 50 tons of finished steel per day, and the pay roll will amount to $7000 per week. The machinery will be in position about February 1, but the mill will hardly be in operation before May."

THE WEEK.

The explosion of Dupont's powder mills, on the Brandywine, on Tuesday, caused the death of 12 men and a pecuniary loss of at least $500,000 to $1,000,000.

The National Board of Steam Navigation commenced its annual session at the Fifth Avenue Hotel, J. W. Miller, president, in the chair, and the annual report was presented.

The Massachusetts Institute of Technology has accepted the offer of Colonel Pope, of the Pope Mfg. Company, to provide a sum not exceeding $6000 for the maintenance of a chair or professorship in that institution in which shall be given instruction in the practical application of engineering to the building of common roads.

No larger exhibition of machinery has ever been made in the West, so a telegram says, than is now seen at the Illinois State Fair in Peoria.

John E. Searles, Jr., treasurer of the Sugar Refineries Company, says that he has no doubt that the effect of the McKinley Tariff bill will largely increase the business of the Sugar Trust, inasmuch as the removal of the duty on raw sugars will reduce the cost of sugar to the consumer very nearly or quite 2 cents per pound, and the tendency will be to stimulate consumption.

The price of rubber appears to have culminated. Starting at 73 cents for new fine Para on January 1, the market steadily advanced until it reached 95 cents by the middle of September. The present price is 88 cents to arrive.

The last stone on the new Government building at Pittsburgh, has been laid. The cost of the work is $1,500,000.

The *Railway Age* publishes a summary of railway construction of the United States in the first nine months of 1890, which shows that 5782 miles of new road have already been built in 39 States and on 202 different lines. The total construction in 1890 will be about 6000 miles, against 5200 reported in 1889.

The cylinders cast at the Brooklyn Navy Yard for the cruisers Nos. 7 and 8, under the superintendence of Chief Engineer Dungan, have been very successful. Careful scrutiny fails to disclose the slightest flaw.

The investigation of charges against Supervising Inspector Dumont came to an abrupt ending, the charges not being signed, and no one was prepared to assume the responsibility.

Contracts for Government vessels to be built by the William E. Cramp & Sons Company foot up $8,765,000.

A successful air ship is announced at Chicago to carry cars as large as a Pullman. E. J. Pennington and Richard Butler, of the Mount Carmel Machine and Pulley Works, are said to be among those interested in starting a "mammoth plant."

Newark, N. J., celebrated on Saturday the opening of the first electric road operated within the corporate limits of the city. The equipment consists of 20 eight-wheel cars, each 32 feet long, which are moved by two 20-horse power Thomson-Houston motors.

The steel conference called by the Secretary of the Navy for October 7, has been postponed to October 16.

Preparations are now far advanced for the commencement of work on the cable road for Broadway, revolutionizing traffic on that important thoroughfare. All legal requirements have been complied with as to right of way and compensation to the city for the valuable franchise. It is a timely suggestion that a beginning should be made in opening a parallel thoroughfare, say by the extension of Centre street, to relieve Broadway from the threatened conjestion.

The recent fire at Colon destroyed the entire city front, including the Panama Railroad office and freight house; also ninety carloads of freight. Loss, $2,000,000. A fire at Sydney, New South Wales, destroyed a large number of business houses with their contents of merchandise. Estimated loss, $7,200,000.

Fred Scheuch, of Lafayette, Ind., for 17 consecutive years American Consul at Barcelona, in Spain, is now connected with a leading Spanish house, and is attempting to get Americans interested in trading with that country. He claims there are many articles that could be exported, and the Spaniards would be glad glad to receive them. During his stay in Barcelona the exports of the United States received at that port increased from $7,000,000 to $15,000,000. Barcelona is the only manufacturing town of any consequence in the country. He is anxious to see American machinery exported to Spain. With this object he is visiting several manufactories in New York and Pittsburg. He thinks that American people should establish a line of steamers running to Spain. He declares that even one steamer to Barcelona from New York in a month would pay abundantly, and it wouldn't be long before the number would be increased.

The first work on the Niagara tunnel was commenced on Saturday, and Niagara village expects to become the "Manchester of America."

Governor Ambrose Shea, of the Bahama Islands, who was in this city last week, says 6000 acres have been planted with sisal hemp within the last few months, and that exports to the United States will soon become heavy.

The new Chamber of Commerce building in Boston will be of granite from the foundation to the roof and will be fireproof in all its parts. The chamber has 946 members.

The plans for the New York and New Jersey bridge have been settled upon by the engineers, but they have not yet been passed upon by the commissioners and stockholders. No date has been fixed as yet for the discussion of the engineers' plans.

The big labor organizations are looking forward anxiously to the annual meeting at Denver, November 13, of the General Assembly of the Knights of Labor and to the December meeting of the American Federation of Labor.

The proposed harbor of refuge at Sand Beach, Mich., is an important improvement. It is situated about 60 statute miles above the mouth of the St. Clair River, and 30 miles below Point Aux Barques, the turning point into the noted Saginaw Bay, the most universally dreaded spot upon the group of lakes. In construction the breakwater differs in no essential respect from similar works at other points on the lakes.

The iron ferryboat Montauk, of the Union Ferry Company Line, was launched from the yard of T. S. Marvel & Co., in Newburg, on the 27th ult She is 209 feet in length over all. The engine is to be a jet-condensing beam cylinder, 50 inches in diameter and 10 feet stroke of piston. The boiler will be tubular, with return flue of ferryboat type 12½ feet in diameter and 31 feet long.

TRADE REPORT.

Chicago.

(By Telegraph.)

Office of *The Iron Age*, 59 Dearborn street, CHICAGO, October 8, 1890.

Pig Iron.—The better feeling reported last week proved to be well founded. Numerous sales are reported, and the month promises to be a period of considerable activity. Among the sales were a number of round lots of Northern and Southern Coke and Southern Car Wheel Irons. Lake Superior Charcoal has been quiet, but negotiations are now pending which may lead to business of an important character. A great deal of Charcoal Iron is being delivered under contract, and in consequence of their large orders the producers are not inclined to force the market. As long as this is the case the nominal price will be sustained and may eventually be made the actual basis of business. While Pig Iron sellers generally anticipate a heavy tonnage this month, they are not sanguine of an advance. Under the circumstances they are inclined to think that much has been accomplished in preventing prices from seriously receding during the quiet period of the past 60 days. It is possible that a buying movement may develop of such strength as to alter their views on this point. An example has been set for a forward step by the Hocking Valley furnacemen, who marked up their prices 50¢ during the past week. Quotations are as follows, cash, f.o.b. Chicago:

Lake Superior Charcoal	$20.00 @	$20.50
Local Coke Foundry, No. 1	17.00 @	17.50
Local Coke Foundry, No. 2	16.00 @	17.00
Local Coke Foundry, No. 3	15.00 @	16.00
Bay View Scotch	18.00 @	....
Am. Scotch (Strong Soft), No. 1	19.25 @	20.25
Jackson County, Soft and Silvery, No. 1	18.25 @	18.50
Southern Coke, No. 1	16.50 @	.....
Southern Coke, No. 2	16.00 @	.....
Southern Coke, No. 3	15.50 @	....
Southern, No. 1, Soft	16.00 @	.....
Southern, No. 2, Soft	15.00 @	....
Southern Gray Forge	15.00 @	.....
Southern Mottled	14.25 @	....
Tennessee Charcoal, No. 1	19.00 @	.....
Missouri Charcoal, No. 1	18.50 @	.....
Alabama Car Wheel	22.50 @	24.00

Bar Iron.—Inquiries from car builders continue to be the prominent feature. In other directions the market is not so animated as it has been. Prices are well maintained by most makers at 1.90¢ for half extras, Chicago, with but one or two mills disposed to take orders at a shade under this rate. Jobbers are so pressed with business that they are inclined to advance their rates on Iron from stock, but as yet have made no actual change from their former quotation, 2.10¢ @ 2 20¢ for full extras, with 2¢ bottom to best trade. Structural Iron is in good demand at unchanged prices.

Plates, &c.—The local trade continues about the same as previously reported, with a slight falling off in certain directions. Some heavy orders have been placed from outside localities. Reports from the mills state that an enormous tonnage of Steel Plates is in sight, so that deliveries cannot be expected to improve. Prices are much firmer and inside quotations are being withdrawn. Another week may see an advance from store.

Sheets—Are still quoted at 3.05¢ @ 3.10¢, at mill, for No. 27 Common Black and 3.30¢ @ 3.40¢ from store, with but light business reported in mill lots.

Galvanized Iron.—Stocks are getting in better shape again, with the mills making more rapid deliveries, but the demand is so large that the prices are stiffer. The usual quotations on small lots. Juniata is 62½ % off up to 60 %.

Merchant Steel—Is fairly active, but n a small way. An occasional inquiry for a large lot is noted, but buyers are averse to paying an advance of $2 or more over the quotations made to them in August.

Steel Rails and Fastenings.—Rail manufacturers report a steady demand for lots of moderate size and maintain quotations at $33.50 @ $34. Fastenings are in good request, with Iron Splice Bars quoted at 2.15¢ @ 2.20¢, and steel, 2.25¢ @ 2.30¢. Spikes, 2.20¢ @ 2.25¢, and Track Bolts with Hexagon Nuts, 3.10¢ @ 3.15¢ for future delivery. Few Bolt makers have any to sell except for delivery far ahead.

Old Rails and Wheels. — Old Iron Rails are in scanty supply and quoted nominally $27. Old Steel Rails, long lengths, have been sold at $22, and short pieces at $18.75; Old Car Wheels have moved in moderate quantities at $18.75 @ $19.

Scrap.—The demand from nearby consumers is not very heavy at present, but dealers have disposed of considerable quantities to mills at other points. A better demand is noted for Borings and Turnings. Dealers quote selling prices per net ton as follows: No. 1 Railroad, $21.50 @ $22; No. 1 Forge, $21; Car Axles, $27; No. 1 Mill, $16.50; Pipes and Flues, $15.50; Horse Shoes, $19.50; Light Iron, $11; Machinery Cast, $13.50; Cast Borings, $9 25; Wrought Turnings, $13; Fishplates, $24; Mixed Steel, $13.75; Coil Steel, $17; Leaf Steel, $18; Tire Steel, $19

Metals.—Offerings of Pig Lead have been light and spot metal is almost unobtainable. Prices have advanced again, and 5.30¢ @ 5.35¢ is bid for October delivery in carload lots. Lake Copper is firm at 17.25¢ @ 17.50¢; Casting brands are quoted at $14.50¢, in carload lots, with a quiet market at present, as heavy buying in September covered consumers' requirements for some time. Spelter is held at 5.30¢, with a good demand.

Howe, Brown & Co., Limited, of Pittsburgh, announce under date of October 1 that their business in Chicago will hereafter be carried on under their own name, with E. S. Jackman as manager. Their Chicago business up to that time had been under the management of Winne & Jackman. The warehouse will be continued at 228 Lake street and 18 and 20 Franklin street, and contain a large stock of fine Steel known on the market as "Howe's brand."

Cincinnati.

(By Telegraph.)

Office of *The Iron Age*, Fourth and Main Sts., CINCINNATI, October 8, 1890.

Pig Iron.—During the last days of September there was some activity in the local market for Pig Iron, with several sales of magnitude, but since the opening of the new month there has been a lull in business, and in some places an easier tone has been incorporated, resulting in sales at prices below the regular market. The largest Southern companies being well sold ahead show no disposition of changing base, and Northern furnaces remain as firm as ever in the views entertained. But there has been considerable outside Iron upon the market which has been responsible for the lower prices, but with this material sold the weakening factor of the market has been eliminated. The largest transactions made recently have been on account of car works and stove foundries, but the run of small orders have represented almost all branches of miscellaneous industries, and in the aggregate have given a fair volume of trade. Mottled Iron has continued especially scarce, throwing consumption more largely upon Pig Forge, which has been sold quite liberally on the basis of $10.25 @ $10.50, cash, at the furnace. The demand for No. 3 Foundry has increased, with sales of considerable amount, mainly on the basis of $11 cash, but this rate has been shaded. No. 2 Foundry and No. 2 Soft have also found buyers in round lots, ranging between 500 and 1000 tons, on the basis of $11.50 and $11 respectively, but in special instances these figures have been cut 25¢ ℔ ton. The movement of Charcoal Iron has been slow, and the demand for Ohio Softeners has been only moderate. Among the largest and most important sales of the week are 2000 tons No. 3 Foundry, 2000 tons No. 2 Soft, 1000 and 800 tons No. 2 Foundry, 1000 Gray Forge, upon the basis indicated. Among the other sales worthy of note were 100, 200, 500, 400, and 100 tons Gray Forge; 600 and 200 No. 2 Foundry; 300 tons No. 1 Foundry; 150 tons No. 2 Soft, 100 tons No. 1 Soft, 300 tons Mottled; 100 and 250 tons No. 3 Foundry; 150 tons No. 1 and 150 tons No. 2 Foundry together, on basis of quotations. At the close the market is apparently upon the eve of some important transactions, at least negotiations are in progress which may yield a liberal volume of trade, having an important bearing upon the future course of the market. We quote the prices current for cash, f.o.b. Cincinnati, as follows:

Foundry.

Southern Coke, No. 1	$15.25 @	$15.75
Southern Coke, No. 2	14.25 @	14.50
Southern Coke, No. 3	13.75 @	14.00
Ohio Soft Stone Coal, No. 1	17.00 @	17.50
Ohio Soft Stone Coal, No. 2	16.00 @	16.50
Mahoning and Shenango Valley	17.50 @	18.00
Hanging Rock Charcoal, No. 1	21.00 @	22.00
Hanging Rock Charcoal, No. 2	19.50 @	20.50
Tennessee and Alabama Charcoal, No. 1	18.00 @	19.00
Tennessee and Alabama Charcoal, No. 2	18.50 @	19.50

Forge.

Gray Forge	13.25 @	13.50
Mottled Neutral Coke	13.00 @	13.25

Car Wheel and Malleable Irons.

Southern Car Wheel	22.50 @	23.25
Hanging Rock, Cold Blast	22.00 @	22.50
Lake Superior Car Wheel and Malleable	21.00 @	22.00

Chattanooga.

Office of *The Iron Age*, Carter and 9th Sts., CHATTANOOGA, October 6, 1890.

Pig Iron.—Contrary to expectations the past week has developed a much better feeling in prices. The demand has increased considerably over the previous week and prices have become much firmer. In many cases an advance has been made of at least 25¢. The demand has been quite prominent for Nos. 1, 2 and 3, and the higher grades have fully kept up to previous conditions, while $11.50 @ $12 for No. 2 and $12.50 @ $13 for No. 1 prevailed. The minimum price at which large round lots were sold can now be named at $12 and $13. Judging from the nature of the sales, which are extending far into the future, there is but little prospect of prices receding; on the contrary, there is the prospect of a still further stiffening up. There is another feature of the condition of the market which is more favorable to the Pig Iron producers, and that is, that the great bulk of the Iron that is now being sold is sold for cash, instead of 60 days and 4 months, which used to prevail, and for this reason the condition of the market may be said to be in a much healthier state than previously. As a general thing the inquiries are expressed with the words: "Please quote us your lowest cash prices, &c." whereas it used to be "Please quote us your 60 days and 4 month prices." Many concerns that used to be rather weak, but who were entitled to credits, now use the former terms. At the present time there is probably not a producer in the South who is storing up Iron, but as a general thing they are nearly all sold up for this year and many of them reaching the first three months of next. Sales for immedi-

ate delivery are very large, but it would now be very difficult to make purchases at the same figure at which sales were made two weeks ago. No. 2, $12 @ $12.25; No. 1, $13 @ $13.25, at furnace bank, are the present ruling prices.

Philadelphia.

Office of *The Iron Age*, 220 South Fourth St., PHILADELPHIA, Pa., October 7, 1890.

Business during the past four or five days has been largely taken up on behalf of the visiting members of the British Iron and Steel Institute and the Verein Deutscher Eisenhuettenleute. It is out of the question to give any detailed report of their doings in the space at our disposal. Suffice it to say that the entertainers and the entertained were equally delighted. Everything that could be done in the way of private and public hospitality was done most generously, and was just as gratefully appreciated and acknowledged. The visit to the works of the Disston's at Tacony before reaching the city proper, gave the party some intimation of what was to follow. This immense establishment, with its upward of 1900 employees, fairly amazed them, and it took but a very few minutes to bring out such remarks as "There is nothing to compare with this in Europe." "It is simply wonderful." One gentleman said: "We are not in it at all," meaning that it was hardly worth while to talk about their being in the Saw trade after seeing such a place as Disston's. Several have expressed their intention to return by way of Philadelphia, in the hope that they may be permitted to make a more extended visit to this and similar establishments.

Pig Iron.—There is a better feeling in Pig Iron, and prices of good Mill Irons are generally held at an advance of about 25¢ ℔ ton. There is no quotable change, as the best Irons can still be had at the outside figure, but there are fewer brands at $15.25, and still fewer at $15, while anything below that (unless for Cinder Irons) is very exceptional. Foundry Irons are also somewhat firmer, but not to the same extent as Mill Irons. Consumption appears to be increasing more rapidly than production, so that for the time being there is some difficulty in getting the exact quality required, unless at more or less of an advance in prices. This firmness is likely to be maintained until after the close of navigation, but the general outlook hardly warrants the idea of permanently higher figures. The fact that sellers quote an advance is, however, a pretty safe indication of a favorable condition of business, and for the balance of the year things are in such shape that it is tolerably safe to predicate on its continuing. Hence, for the current output, sellers are likely to get a better average of prices than ruled during the past six months. To-days' quotations are from $17.50 to $18.25, delivered, for No. 1 Foundry, $16.50 @ $17 for No. 2 and $15 @ $15.50 for Gray Forge. There are a few lots of Cold Short Irons offering at lower figures than above named, but there is no serious competition, and nothing likely to affect the market unfavorably for some time to come.

Bessemer Iron.—The position is very similar to that reported for several weeks past. Consumption is large, and deliveries on old contracts are called for with a fair degree of promptness, but there is very little disposition to make renewals. Nominal prices are $18.50 @ $19 at furnaces, but large buyers stand out for lower figures.

Spiegel and Ferromanganese.—There is nothing to report in the way of sales, as there is not much inquiry, and asking prices are considered a little too high. There are buyers at about $30 @ $30.50 for 20 % Spicgel, and $68 @ $69 for 80 % Manganese.

Steel Billets.—The market is a little irregular, and on the whole is inclined to favor buyers. Nominal prices are $31, delivered, for Nail Slabs, and $31.50 for 4 x 4 Billets, but buyers consider these figures too high, and unless to cover immediate wants are inclined to postpone purchases.

Steel Rails.—There is no material change in the position from last week. There is some demand for Rails, and for paper of various kinds a considerable amount of business could be done, but as a rule cash or short time paper is required. The Illinois Steel Company entered orders for 20,000 tons within the past few days, but the Eastern concerns are mostly handling smaller orders, meanwhile keeping fully employed, on the basis of $30.50 @ $31 at mills. For winter work and satisfactory payment there is little doubt that $30 would be accepted, although Rails are not offered at that figure.

Muck Bars.—There is so little new business that it is extremely difficult to give exact quotations. There is an active demand, but holders ask prices which consumers say are entirely out of proportion with the general market. Some little business has been done at $30, delivered, but most of the makers ask that price and upward at their mills, so that business is very much restricted.

Bar Iron.—There is a good demand and mills are all crowded with work and appear to be hard pressed to make deliveries as promptly as required. New business keeps up remarkably, and there is no difficulty in securing orders at full prices for October and November delivery. For later dates there is not much inquiry, but there will doubtless be all the business that can be handled during the balance of 1890. Prices are firm at about 1.80¢ @ 1.85¢, on cars, at mill nearby, and 1.90¢ @ 1.95¢ at city mills. At a conference of the Bar Iron Manufacturers, held in this city a few days ago, it was decided to adopt with modifications the Western schedule, which is now operative on both sides of the Alleghanies.

Skelp Iron.—There is a fair demand, but buyers are not willing to pay over 2¢, delivered, for Grooved, and 2.15¢ @ 2.20¢ for Sheared. Sellers ask 2.05¢ and 2.25¢, but these figures can only be had for very prompt deliveries.

Plates.—There is plenty of business at full quoted rates for small lots October delivery, but for later dates prices are a shade easier, and desirable orders could be placed at inside figures, in some cases possibly at a little less, although the feeling is by no means weak, and under a very little extra demand prices would soon stiffen. For lots delivered in consumers' yards prices are about as follows:

	Iron.	Steel.
Ship Plates	2.25 @ 2.30¢	2.40 @ 2.50¢
Tank	2.25 @ 2.30¢	2.40 @ 2.50¢
Bridge Plate	2.30 @ 2.40¢	2.50 @ 2.60¢
Shell	2.45 @ 2.55¢	2.60 @ 2.70¢
Flange	3.10 @ 3.20¢	2.90 @ 3.00¢
Fire-Box	3.75¢	3.75 @ 4.25¢

Structural Material.—There is an abundance of work on hand, and very little room for anything additional for this year's delivery. New business is not quite as plenty as it was some time ago, some of the most important requirements having been arranged for, with the result, as above stated, of filling up pretty much the entire capacity for some time to come. Prices as last quoted—viz., for lots delivered in consumers' yards: Angles, 2.20¢ @ 2.30¢; Sheared Plates, 2.40¢ @ 2 50¢, and from 10¢ to 20¢ more for Steel, according to requirements. Tees, 2.7¢ @ 2.8¢; Beams and Channels, 3.1¢ for either Iron or Steel.

Sheet Iron.—The market is firm at quoted figures, and concessions are not considered for the time being. The demand for Light Sheets continues heavy, but mills cannot supply orders as promptly as desired, and in many cases are compelled to refuse them entirely. Carload lots are quoted as follows:

Best Refined, Nos. 14 to 20.....3.00¢ @ 3.10¢
Best Refined, Nos. 21 to 24.....3.20¢ @ 3.30¢
Best Refined, Nos. 25 to 26.....3.40¢ @ 3.50¢
Best Refined, No. 27.....3.50¢ @ 3.60¢
Best Refined, No. 28.....3.60¢ @ 3.70¢
Common, ¼¢ less than the above.
Best Soft Steel, Nos. 14 to 20.....3¼¢ @ 3½¢
Best Soft Steel, Nos. 21 to 24.....3⅝¢ @ 3¾¢
Best Soft Steel, Nos. 25 to 26.....3¾¢ @ 3⅞¢
Best Soft Steel, Nos. 27 to 28..... @ 4⅛¢
Best Bloom Sheets, 1-10¢ extra over the above prices.
Best Bloom, Galvanized, discount..... @ 60 %
Common, discount.....60 @ 65 %

Old Rails.—There is very little change to notice in this department, owing to the extremely small supplies. Buyers bid about $25, Philadelphia, or $26 in the interior, with sellers at 50¢ more. Sales in small lots at medium figures.

Scrap Iron.—There is a fair demand for all kinds of good Scrap, and prices are well maintained at rates recently ruling, viz.: No. 1 Railroad Scrap, $22.50 @ $23; No. 1 Wrought, $21 @ $21.50, Philadelphia, or for deliveries at mills in the interior $22 @ $22.50, according to quality and point for delivery; $15.50 @ $16 for No. 2 Light; $16 @ $17 for best Machinery Scrap, $15 @ $15.50 for ordinary, $15.50 @ $16.50 for Wrought Turnings, $11 @ $11.50 for Cast Borings, $26 @ $28 for Old Fish Plates, and $17 @ $18 for Old Car Wheels.

Wrought Iron Pipe.—Little can be said in this department of the Iron trade, as there has been no deviation from the heavy demand for many weeks past. There is a meeting of the Pipe Association at Pittsburgh to-day. It is hardly expected, however, that discounts will be changed materially. Meanwhile they remain as follows: Butt-Welded Black, 47½ %; Butt-Welded Galvanized, 40 %; Lap-Welded Black, 60 %; Lap-Welded Galvanized, 47½ %; Boiler Tubes, 1¼ inches and smaller, 45 %; 2 inches and larger, 50 %; Oil Well Casings, 50 %.

St. Louis.

OFFICE OF *The Iron Age*, 214 N. Sixth st., ST. LOUIS, October 6, 1890.

Pig Iron.—There is hardly any perceptible change since our last report, except perhaps a trifle more weakness in prices is noticeable. A careful examination of the market discloses a peculiar condition of things. Notwithstanding the fact that production has reached figures that would have appeared startling a few years back, the absorption goes on at a steady pace, and it is quite certain that stocks on the furnace banks are lighter to-day than for many months past. In the face of these facts a steadily declining market has been contended with for the past few months, and there is nothing in the immediate future to strengthen the opinion that better prices can shortly be expected. In some grades of Iron, particularly No. 1 Foundry, the demand has been of such proportions that several furnaces have withdrawn all quotations, notwithstanding the fact that this particular grade is quoted a full 50¢ ℔ ton above the market, which makes it a particularly desirable article to trade in just now. There is no doubt that large quantities of Iron have been booked for future shipment; in fact, many of the furnaces are so well sold up that they are hardly in a position to take orders, except for such grades as are not much in demand.

During the week under review trade has been light, and lots of from 100 to 200

tons have been the rule. Missouri Charcoal Foundry No. 1 is offered at $15.75, cash, on cars here. We quote as follows for cash, f. o. b. St. Louis

Southern Coke, No. 1 Foundry,	$15.50 @ $15.75
Southern Coke, No. 2 Foundry,	14.75 @ 15.00
Southern Coke, No. 3 Foundry,	14.25 @ 14.50
Gray Forge	13.75 @ 14.00
Southern Charcoal, No. 1 Foundry	17.25 @ 17.75
Southern Charcoal, No. 2 Foundry	16.50 @ 17.00
Missouri Charcoal, No. 1 Foundry	15.75 @ 16.00
Missouri Charcoal, No. 2 Foundry	15.00 @ 15.50
Ohio Softeners	17.75 @ 18.50

Bar Iron.—It is difficult to find anything of an interesting nature to report concerning this branch of the Iron trade. The demand continues to increase and the general tone of the market is particularly firm. Local mills quote 1.95¢. Jobbers quote from 2.10¢ to 2.15¢.

Barb Wire.—There is no change in the situation since our last report. Jobbers are replenishing their stocks somewhat, and with the assistance of the demand from country dealers mills are able to market their Wire without much trouble. We quote as follows: Painted, 2.90¢ @ 2.95¢; Galvanized, 60¢ additional. Carload lots, 10¢ ℔ cwt. less than above prices.

Detroit.

WILLIAM F. JARVIS & Co. report as follows under date of October 6, 1890: Among sellers generally the Pig Iron situation seems to be regarded with sanguine expectation for large business at fair figures anyway, and many think advances will be seen in the immediate future. Notwithstanding this hopeful feeling, there certainly may be seen weak spots, particularly in Southern Iron, where the deliveries suit the furnaces. These offerings have caused considerable uncertainty in the minds of many buyers, who are accordingly putting off purchasing where the lowest figures are not granted. This applies, however, to the smaller buyers to a greater extent than the larger ones. Some movement of Lake Superior charcoal shows full prices are obtained, and on certain favorite brands advances have been made. The situation is decidedly hopeful for this grade of metal. Manufactured Iron is in large demand, Bar Iron being as scarce an article as any on the list. Pig Iron prices are as follows:

Lake Superior Charcoal, all numbers	$20.50 @ $21.00
Lake Superior Coke, Bessemer	20.00 @ 20.50
Katahdin (Maine Charcoal)	24.00 @ 25.00
Lake Superior Coke Foundry, all ore	19.25 @ 20.75
Southern No. 1	16.50 @ 17.00
Southern Gray Forge	15.00 @ 15.25
Jackson County (Ohio) Silvery	19.00 @ 19.25

Cleveland.

CLEVELAND, October 6, 1890.

Iron Ore.—Ore is still coming down from the Lake Superior mines at a tremendous rate and the railroad companies are making much better progress in their efforts to relieve the docks of their enormous burdens. During the past week nearly 70,000 tons of Ore were forwarded to the furnaces, this amount being but slightly below the receipts for the same seven days. There is really very little to report beyond a continuation of the demand from Eastern furnacemen and the acknowledged inability of the mine owners to guarantee an output corresponding therewith. The market is therefore firm but almost inactive. The indications point to a somewhat earlier close of navigation than last year. Otherwise the total shipments from the mines will exceed those of 1889 by at least 600,000 tons.

Pig Iron.—There is a strong demand for Ohio Silvery Irons at prices 50¢ ℔ ton in advance of those paid four weeks ago. Numerous sales of these Irons for delivery in from 60 to 90 days are said to have been made. There are few other features of interest. Stocks are so low that furnacemen look forward to a good, healthy demand for all kinds of Pig within 30 days. The consumption of Iron is everywhere reported to be enormous. Mill Irons are to-day reported to be slightly stronger, with indications of an active market in the very near future.

Manufactured Iron.—There is no abatement in the demand and apparently none in the amount of business done. Muck Bar at $30.50 is in great favor, and Common Bar at 1.80¢ is selling as fast as it can be produced. Sheets are scarce and easily command fancy figures.

Old Rails.—It has been confidently expected that prices would decline to at least reasonable figures, but sales are to-day reported at $28 @ $28.50, figures everywhere recognized as exorbitant.

Scrap.—There is a fair amount of business being done. No. 1 Railroad Wrought remains fairly firm at $22 @ $22.50. Old Iron Axles are quoted at $28 @ $28.50; Wrought Turnings, $14 @ $14.50; Old Iron Car Wheels, $18 @ $18.50.

New York.

Office of *The Iron Age*, 66 and 68 Duane street, NEW YORK, October 8, 1890.

American Pig.—It is the general opinion that the output of standard No. 1 Foundry Iron is still closely taken up between the deliveries making on old contracts and the current daily sales. This grade, therefore, remains quite firm. No. 2 Foundry is not in largely excessive supply, yet enough comes out to keep the price about $1.50 ℔ ton below that of the higher grade. Mill Iron is plentiful, and the weak article on the list in company with Bessemer Pig, sales of which are said to have been made at less than $18 at furnace for standard quality. There is little to say of present demand, except that a conservative tendency is manifested by consumers generally, and the offerings reveal no pressure to sell on the part of producers or dealers. Prices remain substantially as given heretofore. We continue to quote $17.50 @ $18 for No. 1 and $16 @ $16.50 for No. 2 Foundry, good Northern brands; $17 @ $17.50 for No. 1, $16 @ $16.25 for No. 2 and $14.75 @ $15.25 for No. 3 Southern. Car Wheel Iron remains at about $20 @ $21 for Nos. 3, 4 and 5 and $19.50 @ $20 for Nos. 1 and 2, delivered.

Spiegeleisen and Ferromanganese.—Very little doing, and the condition of the market is practically the same as it was last week. Consumers claim to be well supplied and sellers hold to about former prices. Twenty per cent. Spiegeleisen is at $30.50 @ $31 for German and about $31 @ $31.50 for English. On 80 % Ferromanganese $70 is the general quotation. The prices are relatively considerably above those at which finished products are selling.

Steel Billets.—No particular change has taken place the past week. The demand is slow in all sections, and $29 @ $29.50 at mill is quoted, with the market barely steady.

Wire Rods.—Domestic have been sold at as low as $41 @ $41.50 at mill. This price is considerably below the cost to import foreign Rods and there is practically no new business in the latter.

Structural Iron and Steel.—New business in this line is on a rather moderate scale, but the mills keep well employed and prices remain steady. We quote at 2.25¢ for Universal Mill Plates, delivered; 2.10¢ @ 2.25¢ for Angles; 2.60¢ @ 2.70¢ for Tees, and 3.1¢ for Beams.

Steel Rails.—Several orders have been placed, involving a total of about 7000 tons for delivery during the next three months. Exact prices are not divulged, but intimated to be chiefly on the basis of $30, at Eastern mills, for standard sections, with 50¢ more obtained for small lots. Comparatively little new business requiring deliveries this year is under way at the present time. There is quite a number for inquiries for 1891 delivery, however, and some contracts are understood to have been taken with prices to be definitely settled later on.

Old Rails.—There has been rather more inquiry, particularly from the West, but buyers' views rarely go above $25 for Tees. That price is 50¢ @ $1 under the figures asked, and little business goes through.

Scrap Iron.—Sales have been made of 300 to 400 tons No. 1 Wrought at $21.50 @ $22 f.o.b. cars at Jersey City, and there is yet a very fair demand.

Warrant Stocks.—The American Pig Iron Storage Warrant Company report as follows:

	Tons.
Stock in yard, October 1	65,800
Put in yard eight days ending October 8	....
Total	65,800
Withdrawn eight days ending October 8	400
Net stock in yard, October 8	65,400

Metal Market.

Pig Iron.—The market has been rather unsettled throughout the week. London prices have advanced and advices from that point indicate some scarcity of supplies available for prompt delivery, but a reaction has since taken place. Late arrivals here have given local dealers a good supply to work on, however, and prices have gradually receded, with sales to out-of-town trade quite frequently made at prices below those quoted to local buyers. Speculative interest here is tame, and the "short" interest in current month delivery is believed to be small. For the matter the impression is that the speculative element stand "long" on the market. Straits has been sold at 23½¢ in 5-ton lots, on and at 23⅝¢ in jobbing quantities, whilst 23⅝¢, net cash, was accepted for sellers' option of delivery all this month, and offers made later at 23½¢. Prompt shipments were offered on Wednesday at 22.65¢, November delivery at 23¢ and December at 22½¢, with 22½¢ the best bid for deliveries this month.

Copper.—Large consumers, it is reported, have made contracts with some of the Lake Superior producers for supplies to last over the balance of the year. The price is understood to be 17¢ and the quantity several million pounds. In the face of this, however, outside lots have been disposed of at as low as 16¾¢, and more could be had at 16½¢. A prominent local dealer is understood to have sold Subrosa at 16¾¢, while making indirect offers of the same price for more or less extensive quantities. Arizona Ingot is rather easier. Sales have been made at 14½¢, which price would yet be accepted for fairly large sized lots. Casting Copper is quoted at 14½¢ @ 14½¢, according to brands, and selling to a fair extent only.

Pig Lead.—There has been a further rise in the price of domestic Lead. Single carload lots have moved off at all the way from 5½¢ up to 5¾¢, and future deliveries, it is asserted, are offered no cheaper. For spot lots, 5.80¢ @ 5.85¢ is asked. Prices for Soft Spanish have advanced to £14. 12/6 in London, making the cost laid down here about 5.30¢ @ 5.35¢. It does not transpire that

any further considerable quantities of foreign Lead have been placed in this market, and deliveries prior to December are not easy to buy. The Western markets have further advanced, 5.30¢ being quoted from St. Louis.

Spelter. — Values have moved still higher and the market is very firm at the advance. The demand is neither extensive or urgent, but supplies at the West are represented as being moderate and the quantity held here is believed to be small. Prime Western has been taken in car-load lots at $5.75 @ $5.85, with latest sales at the latter price for October–November shipment, and $5.85 @ $5.90 is now quoted.

Antimony.—The demand is of merely routine character, and prices are barely steady, with Hallett's quoted down to 19½¢ and Cookson's at 21¾¢ on the spot.

Tin Plate.—A higher level of prices for spot stock has been established all along the line, moving to high cost in the foreign market and favorable position of supplies here. It is believed that large consumers have their probable wants several months ahead well provided for. Dealers are similarly situated and a considerable quantity of Coke Plates is held on speculation. Early in the week fair purchases were made of stock on spot and for future delivery, but operations have been on a rather small scale the past few days, and the demand is moderate at the present time. Quotations for large lots on the spot are as follows: Coke Tins —Penlan grade, IC, 14 x 20, $5.50; J. B. grade, do., $5.50. Bessemer do., $5.50 Stamping Plates—Bessemer Steel, Coke finish, IC basis, $5.40; Siemens Steel, IC basis, $5.50; IX basis, $6.50. IC Charcoals—Calland grade, IX, ——; Melyn grade, $6.12½; for each additional X add $1.50; Allaway grade, $5.50; Grange grade, $5.85; for each additional X add $1. Charcoal Ternes—Worcester, 14 x 20, $5.50; 20 x 28, $11; M. F., 14 x 20, $8; do., 20 x 28, ——; Dean 14 x 20, $5½; do., 20 x 28, $10.25; D. R. D. grade, 14 x 20, $5; do., 20 x 28, $9.87½; Mansel, 14 x 20, $5.12½; do., 20 x 28, $10; Alyn, 14 x 20, $5.12½; do., 20 x 28, $10.25; Dyffryn, 14 x 20, ——; do., 20 x 28, $10.50; Wasters—S. T. P. grade, 14 x 20, $4.65; do., 20 x 28, $9.50; Abercarne grade, 14 x 20, $4.60; do., 20 x 28, $9.50.

New York Metal Exchange.

The following sales are reported:

THURSDAY, October 2.

10 tons Tin, November.....22.40¢

FRIDAY, October 3.

10 tons Tin, December.....22.50¢

MONDAY, October 6.

10 tons Lead, delivery this week.....5.55¢
25 tons Tin, October.....23.35¢

Financial.

An enormous business was done at the New York Custom House during the week ending Saturday night at 12 o'clock, when the final entry of merchandise under the old tariff was made. The total receipts of the week exceeded $6,000,000, or double the average; and the value of imports reported officially was $13,158,145, as compared with $8,000,000 for the corresponding week last year. From this date imports will rapidly decline, while exports will naturally increase. One of the most important questions awaiting decision is that relative to Section 50: Can merchandise now in bond, which paid duty under the old law, but is on the free list in the new law, be withdrawn without payment of duty. The general merchandise markets are unsettled, partly on account of the difficulty in readjusting prices under the new tariff, and of at once carrying them into effect. In dry goods prices are strengthened through higher duties and buyers show more confidence. Agents are shipping many goods on account of old and recent transactions, and the volume of business for the season continues to be recorded the largest on record. Reports of trade with interior jobbers are favorable. Collections are good and the discounting of bills is becoming more general. Breadstuffs are stronger and more active all around, and a "Hutch boom" is possible. Cotton is slow, but stronger, with heavy port receipts—for Monday fully 67,000 bales. Coffee is irregular. Teas weakened. Sugars are not very active, but supplies are kept well in hand and prices are maintained. Wool is improved.

On the Stock Exchange depression rules. The most decided decline was in Reading, Union Pacific, the Grangers, Atchison, Topeka and Santa Fé, North American and Missouri Pacific, while those stocks which exhibited the most strength were Lackawanna, Louisville and Nashville and the Vanderbilt specialties. Some of the prominent stocks sold at the lowest prices of the year. It is explained that on account of the check in speculation growing out of apprehension of trouble from the silver law and other causes, the public have withdrawn, and operators carrying stocks with borrowed money have become tired. The consequence is that securities of the doubtful class are approximating their actual value. Otherwise, as remarked by a distinguished writer, "the brandy treatment administered to the stock market by the Treasury seems to have given it but temporary relief." Recent industrial schemes have fallen through in several instances. Thus the proposed incorporation of the clothing business of Alfred Benjamin & Co., with $500,000 capital, fell flat. The same lack of subscriptions has been shown in the case of the Chicago stock yards scheme and the Massachusetts stove and furnace concern. Nevertheless, from London comes the news that a syndicate has been formed to buy and incorporate John Roach's old ship yards on the Delaware, but this latter report remains to be confirmed.

United States bonds are quoted as follows:

U. S. 4½s, 1891, registered	104
U. S. 4½s, 1891, coupon	104
U. S. 4s, 1907, registered	122⅛
U. S. 4s, 1907, coupon	122⅞
U. S. currency 6s, 1895	114

The posted rates for bankers' sterling are $4.82½ @ $4.83 for 60-day and $4.88 for sight. The market is dull and barely steady. The London *Economist* remarks upon the probability of a further advance of the Bank of England rate, in consequence of the heavy withdrawals of gold for Portugal. The prospect of receiving gold from the United States is considered less favorable.

The weekly bank statement reflects the continued drain of currency West and South by showing a loss of $2,564,200 in the reserve, reducing the total surplus held by the banks to $11,511,210. The change results mainly from an increase of $6,177,200 in deposits, the legal tenders having been reduced only $1,420,900, while the specie increased $401,000. Nearly corresponding with the loss in deposits was an increase of $7,809,700 in loans. Money on call is 3 % @ 6 %. Time money, 6 % for all periods. The demand for commercial has fallen off a little. Prime endorsed bills receivable are quoted at 6 %, and first-class single name paper at 7 %. Money works a little closer on account of the enormous payments for customs, also payments into the New York City Treasury for taxes now due. It is believed that the city banks will be in the market for paper soon. The business of the New York Sub-Treasury was larger during September than for any month since the bond conversions in 1879. The cash payments were $118,598,014.98, of which $30,083,084 were for bonds, $9,462,360 for interest, $10,365,000 for pensions and $5,142,172 for silver bullion. Among the receipts were $16,421,000 for customs and $8,108,000 for currency transfers to the interior.

The total clearings of 58 cities last week show a decrease of 1.8 per cent. Outside of New York there was an increase of 9.5 per cent. New York decreased 8.1 per cent. New Orleans 7.3 and Louisville 7.9 %. Boston gained 1.5, Chicago 19, Baltimore 15.6, Cincinnati 15.1, Milwaukee 59.4, Buffalo 144.9, Galveston, 302.5, Detroit 18.5 and Chattanooga 59.7. Gains are heavy in the far Northwest. Nine months' clearings in all cities show a gain of 9.2 per cent. over the previous year.

Freight shipments from Chicago by all lines last week were 71,823 tons and by lake 79,414 tons.

Imports.

Hardware, Machinery, &c.

Boker, Hermann & Co., Mdse., cs., 30; Arms, cs., 40; Hdw., cs., 6
Carter, Adolf, Arms, cs., 4
Curley, J. & Bro., Cutlery, cs., 7
Degrauw, Aymar & Co., Chain, cks., 3; do., lengths, 11
Field, Alfred & Co., Arms, cs., 116; Mdse., cs., 28
Folsom Arms Co., H. & D., Guns, cs., 14
Folk, J. E., Mch'y, cs., 2
Gerber, G. C., Arms, cs., 17
Graef Cutlery Company, Cutlery, case, 1
Glaser, Jacob, Mch'y, pkgs., 3
Godfrey, C. J., Arms, cs., 2
Hartley & Graham, Mach'y, box, 1
Jordan, A. J., Arms, cs., 11
Meacham Arms Co., Arms, cs., 11; Mdse, cs., 8
Schoverling, Daly & Gales, Mdse., cs., 7; Arms, cs. 27.
Sheldon, G. W. & Co., Arms, cs., 14
Sellers, W. B., Mdse., cs., 2
Von Lengerke & Delmold, Arms, cs., 2
Werlemann, H., Arms, cs., 42
Wiebusch & Hilger, Hardware, pkgs., 61; Arms, cs., 43
Williams & Rankine, Nails, cs., 49
Wyman, Chas. & Co., Arms., cs., 9; Mdse., cs., 46
Order—Arms, cs., 7

Coal Market.

Anthracite Coal operators speak of the market as being in a more satisfactory condition than for many months, deliveries being active and prices firm. It is claimed by all hands that the companies adhere firmly to the adopted schedule, although no important sales have been made at the latest advance—that is to say, September prices are the rule, viz.: Stove, $4.30; Egg, $4.05; Chestnut, $3.95; Broken, $3.75; Pea, Free Burning, is $2.60 @ $2.75, f.o.b. Both Pea and Buckwheat are made in larger sizes than formerly, and these sizes are becoming more generally classified as Nos. 1 and 2. Complaint is made of a shortage of cars, and in some of the mines labor is not in full supply. An increased demand is anticipated, on account of active manufacturing in the Middle and Eastern States. Production for the week, 801,731 tons; total production for the year, 24,971,101 tons, a decrease as compared with last year of 464,927 tons. Reading shipments for the week foot up 200,000 tons, and the Pennsylvania shipments were 237,438 tons, and 106,256 tons of coke. The total coal and coke tonnage on the Pennsylvania for the year foots up 12,619,958 tons, 1,538,893 tons over last year. The Pottsville *Mining Journal* says: "The condition of the trade is hopeful, without being buoyant. Orders are more frequent and larger, and were it not for the stock on hand at the various centers, the mines would be working hard to supply the demand. Unfortunately this stock is still quite large and the October rush will have to continue some days be-

fore its effects will be fully felt at the mines. The price of Chestnut now, compared with one year ago, is 20¢ less, and Broken 15¢ less, which is a good point for manufacturers.

Bituminous Coal is plenty at the mines, but deliveries are slow, on account of the scarcity of cars. Labor troubles, particularly in the Clearfield region, are a source of some worriment. Quotations are $3.25, f.o.b. in New York.

Pittsburgh.

Office of *The Iron Age*, Hamilton Building, } PITTSBURGH, October 7, 1890. }

Pig Iron.—The situation has changed but little during the past week; consumption continues as large as ever, and although production in this district is very large, the supply is still in excess of present requirements, which accounts in great measure for the recent decline The scarcity of coke through want of transportation facilities continues, and several furnaces west of here have already been obliged to bank up in consequence. Prices remain unchanged as compared with those quoted in our report of a week ago, as follows:

Neutral Gray Forge	$15.00	@ $15.25,	cash.
All Ore Mill	15.75	@ 16.25,	"
White and Mottled	14.25	@ 14.50,	"
No. 1 Foundry	17.00	@ 17.50,	"
No. 2 Foundry	16.25	@ 16.50,	"
No. 3 Foundry	15.75	@ 16.00,	"
No. 2 Charcoal Foundry	21.50	@ 22.00,	"
Cold Blast Charcoal	26.00	@ 30.00,	"
Bessemer Iron	17.50	@ 18.00,	"

Some furnace men are refusing to sell Gray Forge under $15.25 and Bessemer below $18, cash, but buyers can supply themselves at $15 for the former, and $17.50 @ $17.75 for the latter.

Muck Bar.—No abatement in demand, and for immediate or near delivery we continue to quote at $30.50 @ $31. Contracts have been made running all through the winter at $30 @ $30.25. It is claimed that there is more money in making Muck Bar for sale than there is in working the same up into finished material, and if this continues mill owners now working wholly in turning out finished material will no doubt become sellers of Muck Bar instead of consumers.

Manganese.—There does not appear to be much inquiry. We are advised of small sales of 80 % domestic at $73 @ $73.50. Foreign is being offered at $69 @ $70 at seaboard.

Manufactured Iron.—There is a continued good demand for all kinds of Merchant Iron and prices are steady. Bars, 1.85¢ @ 1.90¢; Plates and Tank, 2.20¢ @ 2.25¢; No. 24 Sheet, 2.85¢ @ 2.90¢, 60 days, 2 % off for cash. Skelp Iron continued in very active demand, and for immediate or near by delivery it is difficult to find a seller, as they are all over-sold. Prices are firm and higher. Grooved is quoted at 1.85¢ @ 1.90¢, with some sales as high as 1.95¢, and Sheared at 2.20¢ @ 2.25¢. The wants of consumers at present are very urgent, and they do not hesitate to pay a stiff price if they can get the stuff.

Nails.—There is not much doing here in Cut Nails, and prices are quoted as a week ago—$1.85 @ $1.90, 60 days, 2 % off for cash. Wire Nails continue in very fair demand, but there has been no further change in prices; $2.35, 60 days, 2 % off for cash. It is intimated that a desirable order might be placed here below the price quoted, but so far as we can learn, there have been no sales below $2.35.

Wrought Iron Pipe.—The activity noted for several months past continues. There is not so much new business, but the mills are pressed to their utmost capacity on back contracts. There is always a very active demand at this season, as contractors putting down Pipe both for oil and gas are anxious to get all they can into the ground before the bad weather sets in. It looks now as if the mills would be fully employed up to the close of the year. Prices are firm, but unchanged. Discounts on Black Butt Weld, 47½ %; Galvanized ditto, 40 %; Black Lap Weld, 60 %; Galvanized ditto, 47½ %; Boiler Tubes, 1¼ inches and smaller, 45 %; 2-inch and larger, 50 %; Casing, all sizes, 50 %.

Structural Iron.—There is a good demand; mills are all very busy and prices are firm as quoted. Contractors having bridges and large buildings are anxious to get all the work done now that it is possible before the winter sets in. Angles, 2.30¢; Beams and Channels, 3.10¢; Tees, 2.85¢; Steel Sheared Bridge Plates, 2.65¢ @ 2.70¢; Universal Mill Plates, Iron, 2.35¢; Refined Bars, 1.90¢ @ 2¢.

Merchant Steel.—Manufacturers continue to report a very fair business, also that prices are steady. Tool Steel, 8¢ and upward, as to quality and brand; Crucible Spring Steel, 4¢; Bessemer Machinery Steel, 2.35¢ @ 2.40¢; Open Hearth Steel, base sizes, 2.75¢ @ 3¢; Tire Steel, 2.50¢ @ 2.55¢ rates.

Steel Plates.—Market active, but no change in prices. Fire Box, 4.25¢ @ 4.75¢; Flange, 3.10¢ @ 3.20¢; Shell, 2.90¢; Tank, 2.50¢ @ 2.55¢.

Wire Rods.—Still quoted at $41.50 @ $42, cash, at makers' mill. There have been but few sales reported here of late, and while there are but few buyers, there are not many sellers.

Billets and Slabs.—The market for Billets continues weak, but, so far as we are advised, there have been no sales below quotations of a week ago—$29 @ $29.50. It is possible that a very desirable order might be taken below our lowest quotation, but, so far as we are advised, there have been no sales below $29. Nail Slabs about the same in prices as Billets.

Old Rails.—Old Iron Rails are weaker, with sales of 1500 tons to Mahoning Valley consumers at $27.75. The weakness developed within the past few days was caused by consumers, both in the Shenango and Mahoning valleys, being pretty well filled up, and the same is true of those in Pittsburgh. There have been no sales to Pittsburgh consumers for some considerable time; indeed, one of them, who bought largely several months ago, is reported as having sold some. Old Steel Rails are also less active, weak and lower. We now quote at $20 @ $21.

Railway Track Supplies.—There is a continued fair degree of activity, but prices have not changed much of late. Spikes, $2.20, 30 days, free on cars at makers' works; Iron Splice Bars, $1.95 @ $2.05; Steel Splice Bars, $2 @ $2.10. Iron Track Bolts, $2.90 with Square and $3 with Hexagon Nuts.

Steel Rails —There has been but little new business reported here of late, and there is no doubt in regard to the market being weaker. We quote at $30 @ $31, cash, at mill, according to character of order and delivery. Both of the mills here are pretty well supplied with orders.

Old Material.—There have been sales of several hundred tons of No. 1 Railroad Wrought at $22.75, net ton, to consumers out in the Mahoning Valley; Old Iron Axles quoted at $28.50 @ $29, net ton; No. 1 Wrought Turnings, $14.50 @ $15; Old Car Wheels, $18 @ $18.50, gross; Cast Scrap, No. 1 Railroad, $15.50 @ $16, gross; Railway Leaf Steel, $22 @ $22.50, net; Crucible Steel, $27 @ $28, net; Steel Bloom and Rail Ends lower, $22.50 @ $21, gross.

Connellsville Coke.—There is nothing new to note, excepting a continued scarcity of cars, by reason of which some of the furnaces have been obliged to bank up. There is no scarcity of Coke. No change in prices or freight rates.

(*By Telegraph.*)

No change to report in the general Iron or Steel situation, although the feeling appears to be gaining ground that Raw Material has now reached the lowest point. Mills continue to have a good demand for Finished Material, and many of them are considerably back on their orders. The regular monthly meeting of the Wrought Iron Pipe Association took place here yesterday, but about the only thing done was to reaffirm former prices. The Pipe mills are all very busy.

British Iron and Metal Markets.

[*Special Cable Dispatch to The Iron Age.*]

LONDON, WEDNESDAY, October 8, 1890.

In Pig Iron Warrants there has been some irregularity, with a rather lower level of prices all along the line, under the influence of realizations, but a stronger feeling manifested the past few days and a reaction in prices to 52/5 for Scotch, 49/ for Cleveland and 61/ for Hematites. There is at present a feeling that prices must go higher, as the damping of furnaces cuts off about 20,000 tons in the weekly output, while stocks in warrant stores are rapidly diminishing under the drafts made by demands from home trade and for export business. Shipments are running quite large. However, prices move very irregularly and business was done to-day at 51/3 @ 51/6 for Scotch and 48/ @ 48/6 for Cleveland.

Prices for Block Tin have moved about in a rather erratic way, dropping somewhat under the influence of realizing by holders of cash lots and reports of heavier shipments from the Straits, which increase the visible supply, and reacting upon evidence of less pressure to sell. With stocks down to the present level, the "bulls" could doubtless force prices higher, but the scarcity is relieved somewhat by importations from the Dutch market, which while not greatly affecting the position, have some bearing at the present time. It is thought that the effect of scarcity will be felt for some time to come.

The market for Copper has been irregular, Merchant Bar prompts reacting sharply from a decline to £59. 5/, but settling back again to £59 in the face of apparent confidence on the part of largest holders in still higher prices than have yet been reached. Arrivals from America have been small and the Chili charters the last half of last month were only 700 tons. New supplies, it is believed, will continue to run below the consumption, and the future course of prices would appear to depend in a good degree upon the receipts from the United States.

The Tin Plate market is very firm and prices are again higher, with up to 17/ quoted for ordinary Cokes, which are chiefly in demand. Makers express indifference with regard to the provisions of

the new tariff bill as effecting business in the immediate future. At the Gorseenon Works the plant is being doubled.

Scotch Pig Iron.—The market is very unsettled and prices cannot be quoted with any accuracy, as makers have withdrawn all quotations.

No. 1 Coltness,	f.o.b.	Glasgow	Nominal.
No. 1 Summerlee,	"	"	
No. 1 Gartsherrie,	"	"	
No. 1 Langloan,	"	"	
No. 1 Carnbroe,	"	"	
No. 1 Shotts,	"	at Leith	
No. 1 Glengarnock,	"	Ardrossan	
No. 1 Dalmellington,	"	"	
No. 1 Eglinton,	"	"	

Steamer freights, Glasgow to New York, 1/, nominal; Liverpool to New York. 10/.

Cleveland Pig.—Very little business is passing and prices are wholly nominal, with makers asking 50/ @ 50/3 for No. 3 Middlesborough, f.o.b.

Bessemer Pig.—There has been a fairly active trade, and the market is strong, with West Coast brands, Nos. 1, 2 and 3, held at 61/, f.o.b. shipping port.

Spiegeleisen.—Makers have advanced their prices 2/6, and offer very sparingly. The demand is good. English 20 % quoted at 102/6, f.o.b. shipping port.

Steel Rails.—The demand is fairly active and the market firm, but prices are no higher. Heavy sections quoted at £5.2/6 and light sections £5.17/6 @ £6, f.o.b. at N. W. England shipping point.

Steel Blooms.—Prices remain as before and the market firm, with fair demand. Makers quote at £4.18/9 for 7 x 7, f.o.b. at N. W. England shipping point.

Steel Billets.—Business has been fairly active, and the market is firm, without change in prices. Bessemer, 2½ x 2½ inches, £5, f.o.b. at N. W. England shipping point.

Steel Slabs.—Demand is moderately active, and prices remain very steady. Bessemer quoted at £5, f.o.b. at N. W. England shipping point.

Old Iron Rails.—Prices show no further change, but the demand is good and market firm. Tees quoted at £3. 2/6 @ £3. 5/ and Double Heads £3. 5/ @ £3. 10/, f.o.b.

Scrap Iron.—There is still a fair movement and prices are firm. Heavy Wrought quoted at £2. 7/6, f.o.b.

Crop Ends.—No changs has taken place. The demand is fair. Bessemer quoted at £3. 2/6 @ £3. 5/ f.o.b.

Tin Plate.—At the higher prices asked business has been quieter. We quote f.o.b. Liverpool:

IC Charcoal, Alloway grade	17/9 @ 18/
IC Bessemer Steel, Coke finish	17/ @ 17/3
IC Siemens " " "	17/3 @ 17/6
IC Coke, B. V. grade	16/9 @ 17/
Charcoal Terne, Dean grade	16/ @ 16/3

Manufactured Iron.—In this line business has been fairly active and prices are firm, with some advance in Black Sheets and Welsh Bars. We quote, f.o.b. Liverpool:

	£	s.	d.		£	s.	d.
Staff. Marked Bars				@	9	0	0
" Common "	7	2	6	@	7	7	6
Staff. Bl'k Sheet, singles	8	0	0	@	8	2	6
Welsh Bars (f.o.b. Wales)	6	7	6	@	6	10	0

Tin.—Prices very irregular and the market unsettled. Straits sold to-day at £100. 10/ @ £101. 10/, spot, and £99 @ £99. 10/ for three months futures.

Copper.—Operations are smaller and the market is somewhat irregular. Merchant Bars quoted at £59. 10/, spot, and £60 three months futures. Best Selected, £67.

Lead.—There has been a further advance in prices, and the market is strong. Quoted at £14. 10/ @ £14. 12/6 for Soft Spanish.

Spelter.—No further change in prices, but the market very firm. Quoted at £25. 5/ for Ordinary Silesian.

The Dangers of Electricity.

In a paper read by Prof. Henry Morton before the recent convention of the National Electric Light Association, seven rules were given for the protection of those engaged in erecting and operating electrical apparatus involving the use of powerful currents. As these rules have a very wide application, we quote them as follows:

1. Do not touch or handle any electric wire or apparatus of any sort while standing on the ground, or while in contact with any iron work, gas or water pipe, or stone or brick work, unless your hands are covered with rubber gloves, and you are provided with such properly insulated tools as have been declared to be safe and in good order by the electrician or other competent officer of this company. If it is at any time necessary to stand on the ground, or on any surface not insulated from the ground, while handling electric wires and apparatus, rubber boots or an insulated stool should be used. In moving wires hanging on or lying over electric light wires, lamps, or fixtures, use a dry hand line.

2. Never handle any electric wire or apparatus with both hands at once when this can be avoided, and, if it is necessary to do so, be sure that no current is present, or that one or both hands are protected by rubber gloves or other efficient insulation.

3. When handling line wires, treat each and every wire as if it carried a dangerous current, and under no circumstances allow yourself to make contact between two or more wires at the same time.

4. Never open a circuit which has been in use without giving notice to the superintendent, or whoever is in charge, of your intention to do so, and at the same time request that the same line be opened at the main station and kept upen until you have given notice that your work on that line is complete.

5. In the dynamo room never go near the belts or dynamos, nor touch any apparatus unless you are fully informed and instructed how to do so.

6. Tools used by linemen should be provided with insulating handles of hard rubber or other equally good insulator. It is the duty of each lineman to look after his own tools and see that they are in good order, especially as to their insulation. "In construction work, a space of at least 20 inches must be left between the holes for pins on the cross arms, so that a lineman may get to the top of the pole and work without danger."

7. Lamp trimmers and others engaged in the care of lamps must see that the switch putting the lamp in circuit is turned off before they handle the lamp in any way.

The Madison Car Company have been organized to erect freight car works, machine shops and a foundry at Madison, Ill., where 30 acres of land have been secured. The works will employ 1000 men and will have a capacity of 30 cars a day. The capital stock is $500,000, and the following St. Louis gentlemen are among the stockholders: Moses Rumsey, L. M. Rumsey, Chas. Clarke, Gen. J. W. Turner, Seth Cobb, Wm. F. Nolker, W. G. McRee, Williamson Bacon, E. S. Rowse, C. C. Rainwater, A. B. Ewing and T. C. Salveter. It is proposed to begin work on the buildings in October.

Steamships on the Pacific.

English newspapers ascribe more than usual importance to the launch of the first of the steamships in course of completion for the Canadian Pacific Railway, to ply between British America and the ports of China and Japan in opposition to the Americans, who thus far have had the Pacific trade largely in their own control. The event is significant because it marks the near realization in its fullness of the grand scheme for connecting Europe with the Asiatic Coast, by means of a British trans-continental railway line on American soil. The railway was commenced in 1880 and in 1885 the road was actually finished, and had trains running through from Halifax and Quebec to Vancouver. The pioneer ship has been named the "Empress of India," and two months hence she will be ready to go on the route, "forming," as the British say, "a valuable and necessary link between two important parts of our colonial empire," or, as elsewhere remarked, opening "the imperial route to Great Britain's possessions in the colonies and in the far East." The three steamers are built strictly in accordance with admiralty requirements, convertible into war cruisers or troop ships in case of necessity. Their engines will indicate about 10,000 horse-power, and they are to be propelled by twin screws, the engine room being divided by a fore and aft bulkhead, and the propeller, or tail end shaft, being carried within the structure of the hull to the extremity, thus doing away with the external support known as the "A" bracket principle. The hull is subdivided by 12 transverse water tight bulkheads. The four boilers supplying the engines with steam are placed in two compartments divided by a cross bunker, and fully protected by wing bulkheads and side bunkers. Arrangement is also made for the protection of the engines by coal in the event of the vessels being taken up as armed cruisers.

The dimensions are 485 feet over all, or 440 feet between perpendiculars; breadth 51 feet, depth 36. The ships are contracted to do 18 knots on the measured mile and 16½ knots on a 400 mile trial at sea. Each vessel is 5700 tons. What effect the Canadian line will have in diverting the silk and tea traffic from the American route via San Francisco it might not be safe to predict, but the heavy capitalists interested in the five or six continental lines through "the States" will hardly consent that they shall have their own way undisputed. With a subsidy bill in force, which is not improbable, the ultimate establishment of two or three American lines follows almost as a matter of course. A line from Tacoma may be considered assured in any event at an early day. The Pacific side of the continent offers a fine field for American enterprise, both transatlantic and coastwise, and is sure to be improved.

A combination of the locomotive engineers and conductors on the Northwestern system has for its object "to secure any just concessions without resorting to a strike."

The Southwestern Wisconsin Miners' Co-operative Association met at Shullsburg, in that State, on the 2d inst., and resolved to establish plants for the production of zinc oxides and spelter in order to make a market for the vast quantity of zinc ores mined there. Another meeting was held October 8, when detailed plans were submitted.

HARDWARE.

Condition of Trade.

Advices in regard to the volume of business are very satisfactory, and it is evident that the trade have no reason to complain. A steady business is doing in assorted orders from retailers throughout the country, in which seasonable goods have a prominent place. There is also a good demand from jobbing houses, who in many lines are obliged to replenish their stocks, owing to the large trade which is doing in the principal centers. Prices are also regarded as in a healthy condition, being well maintained on the general line of goods, with a strong tone in some cases. The causes which tend to give this strength to prices are several, and among them may be mentioned the increased cost of raw material, the effect of higher duties on certain goods, combination among manufacturers and the excellent demand. In many lines manufacturers are exceptionally busy, and there is more or less complaint of difficulty in obtaining goods promptly. Export business continues in good volume, but without special features that call for mention. The increasing enterprise of manufacturers in looking after this trade is a matter for congratulation.

Chicago.

(*By Telegraph.*)

The general Hardware trade continues to be exceedingly active. On visiting the several jobbing houses the packing departments appear to have overflowed into other parts of the stores. A general demand seems to be imminent for more room. The condition of trade has never been better than it is at present. This remark applies equally well to the heavy Hardware jobbing houses. They report that never before have they had such a large demand from such a wide expanse of territory. They are shipping largely to the far West and are sending a great deal of wood stock to the Atlantic seaboard. Wagon material is being sent into Pennsylvania from here, and to Troy, Albany and numerous other Eastern points. The wagon builders all over the country are doing an extraordinary business and this causes the very great demand for heavy Hardware. A single house here booked orders last week which would require 35 to 40 cars per day to take care of the shipments. The immediate effect of the new Tariff bill is seen in the increased price of Anvils.

Barb Wire.

The market continues rather quiet, but prices are well maintained, and while there has been no advance, the market is firm. Quotations continue on a basis of 3.30 cents per pound for Four-Point Galvanized at mill.

Chicago (*By Telegraph*).—This branch shows no change, the demand continuing fair, and small lots selling at $2.90 for Painted and $3.50 for Galvanized.

Wire Nails.

During the past week there has been only a moderate demand for Wire Nails, but the price has remained without change, the market being characterized by a fairly firm tone. Quotations are on the basis of $2.40 for carload lots at mill. Small lots from store are quoted at $2.60 to $2.70.

Chicago (*By Telegraph*).—The drop in prices which occurred in the past two weeks seems to have frightened buyers to a considerable extent, as not many orders are known to have been placed lately, although inquiries are numerous. The heavy buyers are looking for still lower prices, and then, as usual, they will place large orders and be in good shape to take advantage of the market when manufacturers put up their prices again. The usual quotation for Wire Nails from factory in Chicago is $2.40 @ $2.50, but one or two concerns would probably shade this. A meeting of the Wire Nail manufacturers is to be held this week, and it is possible that some measure of relief may be adopted which will prevent further demoralization of prices. The quotation from stock is $2 60, but this price is shaded when influenced by the sale of other goods in close competition.

Cut Nails.

The New York Nail market is in the same condition as at our last review, with a fair but not heavy business. Quotations for Iron Nails are as follows: Round lots at mill, $1.80; at dock, $1.90. The price from store is $2. Steel Cut Nails are 10 cents higher than the above figures.

Chicago (*By Telegraph*).—The volume of the business in this branch is larger than it has been. Orders are being placed to a considerable extent by large buyers, who evidently believe that prices are low enough to stock up on. It would seem that, in comparison with Steel, the price of Nails must be very close to cost, if not, indeed, below it. Manufacturers assert that, taking the cost of raw material, Cut Nails are now lower than they ever were before. Wheeling mills quote $1.70 to $1.75 at mill for usual specifications. Carload prices in Chicago range from $1.90 to $1.95. Small lots are selling from stock at $2.

Miscellaneous Prices.

A still further advance in Shot was made under date October 3, the new prices being as follows, subject to a discount of 2 cents per bag of 25 pounds if paid within five days from receipt of bill:

Drop Shot, per 25-pound bag	$1.62
Drop Shot, per 5-pound bag	.38
Buck and Chilled Shot, per 25-pound bag	1.87
Buck and Chilled Shot, per 5-pound bag	.43
Dust Shot, per 25-pound bag	2.25

The following changes in the price of Lead Pipe, &c., were made under date October 1, subject to the usual discount:

Lead Pipe, per pound	$0.08
Block Tin Pipe, per pound	.45
Sheet Lead, per pound	.08¾
Tin Lined Pipe, per pound	15

Owing to the advances in silver, copper and nickel, and other articles entering into the manufacture of the goods the manufacturers of Silver Plated Flat Ware have announced an advance of about 10 per. cent. in these goods,

Horseshoes are unchanged, the prices which have been ruling for some time being still continued. This line of goods is recognized by the trade as one of the most steady, changes in price being made only when necessitated by important fluctuations in Iron.

Some rumors have been current in regard to a combination among the manufacturers of Ground and Unground Hol low Ware, but inquiry fails to discover any foundation for them. The understanding between the manufacturers which has prevailed for the past two or three years still continues, but it is not understood that there is any intention to form a consolidation of interests or to change existing agreements, which are regarded as working quite satisfactorily.

The revised tariff is still having its effect on the prices of imported goods, though it was to a certain extent discounted and many advances made in anticipation of its passage. There has, however, been occasion to mark up further the prices of many goods, and importers are naturally ready to avail themselves of the opportunity. The effect of the tariff will be felt in a marked degree by Cutlery and Guns, and it will doubtless result in considerably diminished importations of these goods. Manufacturers in this country are taking energetic measures to avail themselves of the opening which is thus given for the production of goods which heretofore they could not profitably make, and there is little doubt that they will thus be enabled to produce an enlarged line. The cheaper grade of Pocket Knives are especially affected. The continuance of high prices on the other side also tends to increase the price of the imported goods, and serves as an additional protection to the American manufacturers. The stock of imported goods on which duties have been increased is large, and it will take some time to dispose of it.

Owing to increased duties and recent advances Peter Wright's Anvils are now quoted by importers from stock at 11½ cents per pound, and the Armitage Mousehole at 10½ cents per pound.

The Hartford Hammer Company, Hartford, Conn., advise us that they make a different discount on their Nail Hammers and their Machinists' and other Handled Hammers, the former being quoted at a discount of from 35 and 10 to 40 and 5 per cent., and the latter at a discount of from 50 to 50 and 10 per cent.

The following revised prices on Sisal Rope are announced under date October 2. Terms, f.o.b. New York, 60 days, or less 1½ per cent. for cash in 10 days:

	Per pound
Sisal Rope ... basis,	10¼¢
" Hay and Hide Rope, coarse and medium	8⅛¢
Sisal Hay and Hide Rope, fine	9 ¢
" " " extra fine	9⅛¢
" " " if laid..extra,	⅛¢
" " " if unoiled, "	⅛¢

The following are the revised prices of Eureka Wringers, manufactured by Bailey Wringing Machine Company, Woonsocket, R. I., by whom they are now made as successors to the business of the Eureka Wringer Company:

Genuine Eureka Wringers.

Description.	Size of roll. Length, inches.	Size of roll. Diameter, inches.	Retail prices, each.	Wholesale prices, per dozen.
No. 2, small family size.	10	1¾	$3.50	$21.00
No. 3, medium family size	11	1¾	4.00	25.50
No. 4, large family size.	12	1¾	4.50	30.00
No. 5, small hotel size.	14	1⅞	5.50	39.00

Sterling Elliott, Newton, Mass., announces the following advanced prices of his Cutting Off Tools, subject to a discount of 25 per cent. to the trade:

No. 1..... $10.00
No. 2..... 5.00

The passage of the revised tariff bill has made some changes in the law regulating the importation of Window Glass. Under this bill the duty on imported window Glass, on all sizes larger than 24 x 36 inches, will be raised from an average of 115 per cent. to an average of about 150 per cent. Glass now must all be unpacked and weighed and repacked. It has been the custom to estimate Single Strength Glass at 1 pound a square foot or 50 pounds for a 50-foot box, and Double Strength at 80 pounds to a 50-foot box, but now all Unpolished Cylinder, Crown and Common Window Glass must be imported in boxes containing 50 square feet as nearly as sizes will permit. This seems to prevent the use of boxes containing 100, 200 or 300 feet as before, thus increasing the cost of packages, while the provision that the duty is to be assessed on actual weight necessitates considerable labor in weighing the Glass apart from the boxes. Owing to this state of things it is thought likely that the price of imported Window Glass will be advanced. On Ground Glass, Single Clear Enameled, Single Obscured, Double Clear Enameled and Double Obscured Enameled Glass, the new law imposes an increased duty, in consequence of which the price on Ground and Enameled Glass was advanced to-day.

L. A. Sayre, Newark, N. J., has added to his line of Ticket Punches a Punch suited to the demand from the special advertising trade. The attention of the trade is also called to his Improved Belt Punch, on which the price has been reduced.

Foster, Stevens & Co., Grand Rapids, Mich., have recently issued the following circular relating to Hardware prices. Extracts from it have appeared in print, but we give the circular complete with a reply from a leading representative of one of the lines of good to which it relates. While the circular was intended for their customers, it will be of interest to the trade at large as giving their views of the market:

As important and rather radical advances in prices of some articles in the Hardware line are daily taking place, we wish to say a few words so you may fully understand the situation and not think that the jobber is overcharging you.

Axes.—There is now but one Axe company in the United States, and that is called the American Axe and Tool Company, with headquarters at Pittsburgh. This company have purchased outright every Axe factory in the country of any importance, and by thus controlling the production have advanced prices on an average of $2 a dozen. This company also control the manufacture of axe polls (or the head of axes), the machinery of which is patented, and this enables them to keep the price on polls so high no one else can afford to make Axes.

Saws—Hand and Cross Cut.—In this industry the same forces have been at work, and to-day there are but two companies who manufacture Hand Saws, where there were a dozen four months ago. Prices in this line of goods have been advanced from 10 to 40 per cent. In Cross Cuts it is the same. By a consolidation of interests prices have been advanced from 4 to 8 cents a foot.

Lead.—Everything made of Lead has taken a decided advance owing to recent decisions on the admitting of Mexican ore into this country, as well as by combinations of manufacturers. Shot, Lead Pipe, Pig Lead, Solder, Babbit Metal have all advanced, and may go still higher. The passage of the Silver bill will also affect all articles made of or coated with Silver. In the Hardware line Plated Knives and Forks, Spoons, &c., will be affected and advances made.

Tin.—The present tariff on Sheet Tin is 1 cent a pound, and the McKinley Tariff bill, which no doubt will pass both Houses of Congress, advances the duty to 2 2-10 cents a pound. This must, of course, advance Tin from $1.25 to $3 a box, according to the weight of said box. This advance in Sheet Tin will affect all articles of Tinware, and advances will be made all along the line. Tin in New York has already advanced from 50 cents to $1 a box, and is growing stronger each day, as the certainty of the passage of the McKinley Tariff bill becomes more assured. Not a box of Tin is made in this country, notwithstanding which Tin has declined in price from $15 to $4.75 a box during the past 25 years.

Glass.—The Window Glass market of this country is practically in the hands of two large companies, who work in harmony as to prices, which has resulted in a steady advance for the past year, averaging about 30 per cent.

Zinc or Stove Boards.—The Adams & Westlake Company, A. I. Griggs, Sidney Shepard & Co., Palmer Mfg. Company, H. Rendtorff & Co., Central Stamping Company, W. H. Sweeney Mfg. Company. All of the above named firms were anxious for our business last year, but now they have all sold out to the American Stove Board Company, with offices in New York and Chicago, and a general advance on all lines has taken place. Last year you could buy a 28-inch square paper lined Zinc for 36 cents. This year the same thing costs you 72 cents. An advance of 100 per cent.

Ammunition.—The price is controlled by a combination, and you have to pay the price or go without.

Powder.—The same—but one price, and that nearly double what it was two years ago.

Summary.—We call your attention to these matters so you will understand why, on nearly every invoice you get, you will find something higher than it was before. The tendency of the times seems to be consolidation, thus enabling large corporations to produce the goods cheaper and sell them at higher price. We fail to find, however, in all thec onsolidation of various lines of goods, a single instance, notwithstanding the advance they put on goods, where they have advanced the pay of labor a cent. If the consumer who purchases last does not pay this increased cost we do not know who does. If he reaps any personal benefit from it we would like to know where it comes in. This is not a political document, but a fair statement of the condition of certain lines of business as we daily come in contact with them.

It will also interest the trade to read the following reply by Henry Disston & Sons to the above comments, so far as they relate to Saws and the advances in prices which have recently been made. It is in the form of a letter to Foster, Stevens & Co., under date October 2:

GENTLEMEN: Our attention has been called to your circular letter of September 9, addressed presumably to the retail Hardware trade, but which evidently from its tenor was intended to reflect on the various manufacturers of the goods designated by you, such as Axes, Saws, Stove Boards, &c. It had been our intention not to heed or answer any further remarks relative to prices of our goods, as we had during the last campaign clearly demonstrated to the public that the charges made against us for discriminating against the home consumer were false in every respect. However, the assertion made by you relative to an advance in price on Hand and Crosscut Saws from 10 per cent. to 40 per cent. demands that some justifiable cause be assigned for such an increase. You have been customers of ours for many years, and we cannot believe that you would knowingly do us an injustice, but we respectfully ask you to refer back to the years 1881 and 1882, and compare the prices then with what they were June 1, 1890. You will find there had taken place during that interval a reduction on some goods of from 40 per cent. to 50 per cent., especially on Crosscut Saws, while both the best and cheaper grade of Hand Saws had also steadily declined, especially the latter. The cheapest Hand Saw made then was $4 per dozen net, and the cheapest now, under new prices ruling to-day, is less than that figure. Narrow Champion Saws were then sold at 25 cents per foot, net, while to-day, under the new order of things, they come at a less price. We could go on and enumerate our other lines, and the comparison would be about the same. You are aware that on certain goods, such as cheap Hand Saws, Narrow Champion Crosscut Saws, the No. 1 and No. 2 Champion, and One Man Champion Crosscut, the prices for the past eight years had been getting lower and lower until they were being manufactured at an absolute loss. The advance on our Standard brand of Saws has been very slight, just about 5 per cent., and the increase on the Saws named above has been made so as to give us a fair margin of profit. You say that you failed to find in a single instance wherein the pay of labor has advanced 1 cent. Permit us to say, that while we are ignorant as to what other manufacturers have done, the wages of our men were immediately raised when our new prices went into effect, they receiving pay for ten hours while they work nine only, being practically an increase of 10 per cent. After taking this extra pay into consideration, and the difference between the old and new prices ruling to-day, the net result to us would be very small. We maintain whatever advantage has resulted from the recent consolidation of interests has been as much to the benefit of our workmen as to ourselves.

Scythe Lists.

As we observed in our last issue, there is some diversity in the lists used by the different Scythe manufacturers. While most of these closely approximate what has been regarded as the standard list, there have been gradual departures from it, making it advisable for buyers to be familiar with the lists of the different manufacturers, as the discounts named do not always determine the price of the goods. In order to lay the matter fully and clearly before the trade, we give below the lists of the various manufacturers, which will be of interest also in indicating the brands made by them. There is also some diversity in the discounts made, but it is understood that in a general way the prices which are regularly quoted to the large trade are not materially different. There are, however, sufficient differences in price to make it worth while for buyers to look carefully into the matter. We give below the lists of the following manufacturers: Auburn Mfg. Company, Auburn, N. Y.; American Axe and Tool Company, Pittsburgh, Pa.; David Wadsworth & Son, Auburn, N. Y.; H. Knickerbacker, Balston Spa, N. Y.; Winsted Mfg. Co., Winsted, Conn., and Dunn Edge Tool Company, Oakland, Maine:

AMERICAN AXE AND TOOL COMPANY.

Grass Scythes.

	Per doz.
All Steel, full polished, boxed and sharp.	$11.00
Cutlass Steel, extra finish, boxed and sharp	10.00
Clipper, boxed and sharp	9.00
Honest Dutchman, boxed and sharp	8.50
Waldron Pattern " " "	8.50
German Steel, painted, in straw	7.66

Grain Scythes.

	Per doz.
Waldron Pattern, boxed and sharp	$12.00
Silver Steel, " " "	12.00
Clover, " " "	12.00
Clipper, " " "	12.00
Common Grain, not sharp, in straw	10.50
Brush Bramble and Weed Scythes, painted red or green, ribbed in straw	8.22
Lawn Scythes, same price as Grass Scythes in corresponding finish.	
Imperfect Grain Scythes, when in stock	7.50
Other kinds	6.00

AUBURN MFG. COMPANY.

Grain Scythes.—Ground Sharp and Boxed.

	Per doz.
Clipper Grain.—Extra Full Polished Blade and Back, Green, Bronzed set	$11.50

Grain Scythes.—Packed in Straw.

Empire Silver Steel, Full Polished Blade and Back, Red, Bronzed set	11.00
Cast Steel, Full Polished Blade and Top of Back, Red	10.50
German Steel, Full Polished Blade, Blue	10.50
Half Set, Cast Steel, Top of Back Polished, Painted Blade, Green	10.50
Extra for above Grain Scythes when Ground Sharp and Boxed	.50

Grass Scythes.—Ground sharp and boxed.

Honor Bright, Fine Razor Steel, Full Mirror Polish	$10 00
Our Best, Extra Full Polished Blade and Back, Bronzed	9.50
Acme, Extra Full Polished Blade and Back, Two Ribs, Striped, Green	9.50
Mowers' Choice, Full Polished Blade and Back, Beaded Blade, Red and Bronzed	9.25
Our Clipper, Full Polished Blade and Back, Bronzed set, Red	9.00
Our X L Clipper, Full Polished Blade and Back, Bronzed set, Red, Extra Light Weight	10.00
The Latest, Full Polished Top and Bottom, Bronzed Set and Heel, Extra Light Weight	12.00

Grass and Lawn Scythes.—Packed in Straw.

The Racer, Top of Back Polished, Blade Bronzed, Bottom Red	8.25
Ready for Grass, Top of Back Polished, Green	8.25
Honest Dutchman, Top of Back Polished, Blade Bronzed, Bottom Red	8 25
The Favorite, Top of Back Polished, Two Ribs, Green and Striped	8.25
Silver Steel, Half Set, Full Polished Back, Red	8.25
Cast Steel, Full Set, Polished Blade and Top of Back, Red	8.25
German Steel, Half Set, Painted Green or Blue	7.66
Waldron Pattern, Cast Steel, Full Set, Blade and Top of Back Polished, Red	8.25
Waldron Pattern, German Steel, Painted Blade, Blue	7.66
Half Set, Cast Steel Lawn, Green or Red	8 25
Extra for above Grass and Lawn Scythes, Ground Sharp and Boxed	.25

Bush or Bramble and Weed Scythes.—Strawed in ½ Dozen Packages.

A Pattern, Bush Ribbed, Full Polished Back, Green	$8 50
B Pattern, Bush Ribbed, Steel Back, Red or Blue	8.22
Railroad or Weed, Ribbed, Steel Back, Green	8.22
New Orleans Bramble, Full Set, Oiled, Polished Web	8.22

H. KNICKERBACKER.

Grain Scythes.

Clipper, full polished, boxed and sharp	$11.50
German, cast or silver Steel, either half set or Waldron, in straw	10.50

Grass Scythes.

Silver Clipper, boxed and sharp	$9.00
Cutlass Steel, both webs polished, boxed and sharp	10.50
German Steel, beaded or half set, Young America, or half set Waldron, boxed (if in straw 25 cents less)	7.91
Cast Steel, and German Steel, full set or Waldron, German Clipper, Western Dutchman and Rough and Ready, sharp and boxed (if in straw 25 cents less)	8.50
Bush, Bramble and Weed Scythes	8.22
Clover Scythes	9.50
Imperect Grass	6.00
Imperfect Grain	7.00
Imperfect Weed and Bush	6.00
Lawn Scythes, same price as corresponding finish.	

DAVID WADSWORTH & SON.

Grain Scythes.—Boxed and sharp.

Clipper Grain	$11.50

Grain Scythes.—Packed in straw.

Silver Steel Grain Scythes	$10.50
Silver Steel Waldron Gr'n Scythes, oiled.	10.50
Harvest Victor Grain Scythes	10.50

Grass Scythes.—Boxed and sharp.

Clipper Grass	$9.00
Silver Steel	8.50
Gilt Edge	8.50
Silver Steel Waldron	8.50
Honest Dutchman	8.50
Diamond Edge	8.00

Grass Scythes.—Packed in straw.

Extra Steel Back	$7.66
Half Set Waldron	7.66
Bush Scythes, Red, Green or Blue	8.22
Weed Scythes, Red, Green or Blue	8.22

Lawn Scythes, same as Grass of corresponding finish.

Imperfect Scythes.—When we have them.

Grass, Bush and Weed Scythes	$6 00
Grain Scythes	7.50

WINSTED MFG. COMPANY.

Grain Scythes.—Sharp and Boxed.

Clipper	$13.00

Grain Scythes.—Packed in Straw.

The Diamond Grain	$11.50
Waldron	12.00
Silver Steel	12.00
King of Grain	12.00

Grass Scythes.—Sharp and Boxed.

Waldron, full set	$4.50
Cast Steel	8 50
Silver Steel, Ribbed	8.50
The Dutchman	8.50
The Diamond	8.50
Clipper	9.00
Crown Jewel	9.00
Cutlery Steel	10 00
Eureka, or Red, White and Blue	10.00
Dutch Clipper	10.00
Our Best	11.00

Grass Scythes.—Packed in Straw.

Waldron, half set	$7.66
Steel Back	7.66
Congress	8.00

Lawn Scythes,
same price as Grass of corresponding finish.

Miscellaneous Scythes.—Packed in Straw.

Bush	$8 50
Heavy Bush	8.50
Bramble	8.50
Weed	8.50

DUNN EDGE TOOL COMPANY.

Grass Scythes.

Waldron's Pattern, boxed	$8.50
Western Dutchman, sharp and boxed	9.00
Clipper, sharp and boxed	9.00
Fine Cutlery Steel, sharp and boxed	10.00
All steel, sharp and boxed	11.00

Grain Scythes.

Waldron's Pattern, boxed	$12.00
Silver Steel, boxed	12.00
Clover, boxed	12.00
Clipper, sharp and boxed	12.50

Imperfect Scythes, when in stock.

Grain	$10.00
Other kinds	8.00

Lawn Scythes.

Cast Steel	$8.50
Clipper	9.00

Bush and Bramble Scythes.

German Steel	$8.50
Cast Steel	8.50
Cast Steel, Weed or R. H	8.50

G. & M. Nolin, Skowhegan, Me., are also manufacturing Scythes, and quote their Clipper from a $9 list. Emerson & Stevens Mfg. Company, Oakland, Maine, are also making Scythes, but we are not advised as to the list they use.

Items.

Under date October 1, the American Axe and Tool Company, announce that their offices at Pittsburgh, Pa., Boston, Mass., and Troy, N. Y., will be discontinued on 15th inst. On and after that date all correspondence is to be addressed to the new office of the company, room 65, Stewart Building, New York.

The Accurate Time Stamp Company, 431 Eleventh avenue, New York, have recently reorganized and have put in more money in order to meet more efficiently their increasing business in the manufacture of Automatic Time and Dating Stamps and Watchmen's Time Detectors. They have also made a change in the method of conducting their business, as they are now putting the instruments at rental instead of selling them as heretofore. The officers of the company are as follows: Jas. S. MacCoy, president; Chas. Stahlberg, vice-president and superintendent; Albert P. Fisher, secretary and treasurer, and James D. Henderson general manager. The company issue a neat pamphlet describing their Time Stamps and giving information in regard to their use.

Announcement is made by the Yale & Towne Mfg. Company, Stamford, Conn., under date October 1, 1890, that in order to provide for the increasing business of the company a number of changes and appointments have been made in its executive staff. Schuyler Merritt, since 1878 secretary of the company, and since 1884 general manager, has resigned the latter position in order to give attention to other interests, but still retains that of secretary. Mr. Merritt will have charge of the company's legal and patent affairs and of the business of department B, Bank Locks. W. F. Donovan, since 1880 manager of the Chicago house and of the company's western business, has been appointed general manager with headquarters in Stamford and New York. Geo. S. Redfield, recently manager of the Tubular Axle department of the National Tube Works Company, McKeesport, Pa., has become manager of department A, Locks and Hardware, in the Stamford office. B. H. Warren, recently superintendent of the Hancock Inspirator Company, Boston, has been appointed manager of Department C, Cranes, &c., and D, Pulley Blocks, Hoists, &c., in the Stamford office. Henry H. Suplee recently editor of *Mechanics* and also consulting engineer in Philadelphia, has been appointed editing manager in the Stamford office. Mr. Suplee will have entire charge of the presentation of the products of the company before the public, including all editorial work and advertising. W. H. Bryan, recently secretary of the Heisler Electric Light Company, St. Louis, has become manager of the Chicago house, succeeding Mr. Donovan. It is also stated that Frank H. Taylor, formerly president of the Belmont Iron Company, Philadelphia, was appointed in February last, manager of the Philadelphia house, vice John T. Boyd, resigned.

Dayton, Hall & Avery, Portland, Ore., issue an invitation from their temporary headquarters to call upon them this fall in their new building, which will then be finished, on their old stand, 194 First street, corner Taylor, and at the same time call attention to their Wildwood brand of Axes, Crosscut Saws, Cutlery, Hatchets, &c.

E. A. Eaton and E. A. Norwood, Bellows Falls, Vt., announce under date of September 29, that they have formed a co-partnership under the firm name of Eaton & Norwood, and will continue the business formerly conducted by E. A. Eaton. It is stated that all debts contracted by the former firm will be settled by Mr. Eaton, to whom the payment of outstanding bills is to be made. Mr. Norwood has for the past nine years been connected with Knowlton & Stone, Keene, N. H.

Champion Safety Lock Company, Cleveland, Ohio, announced October 1 that on and after that date they will discontinue their New York office, at 92 Chambers street, and will hereafter be represented in the New York market by Naylor & Flack, 121 Chambers street, who will carry a complete stock of the company's Champion Meeting Rails, Sash Locks and Champion Side Sash Locks.

Northampton Cutlery Company, Northampton, Mass., in addition to there well known lines of Steel Cutlery, are manufacturing a large variety of Silver Plated Knives, Forks and Spoons, branded American Silver Plate, Star Cutlery Company, and Northampton No. 12. They advise us that they are continually adding new patterns and increasing the general output of the works.

The Chapman Mfg. Company, Meriden, Conn., are making a number of new styles in Dog Collars, made of Ooze calf skin, a new leather of exceptional finish. In their advertisement on page 95, a handsome design in this leather is shown.

An advertising novelty that is being sent out by the Ætna Boot and Shoe Hard-

ware Company, Unionville, Conn., is a Check Cutter and Desk Rule, made of sheet metal and struck up so as to avoid the flatness that ordinarily pertains to articles of its class. It is in the form of a square, with inches and fractions along the longer arm. On the upper side are printed various advertisements of the company. It is something which most receivers put in use upon their desks.

The "H. & D." Truck Company, Elizabethtown, Pa., manufacturers of Stove Trucks, have been succeeded by J. G. Dulebohn, of the same place.

E H. Wayne, 422 Commerce street, Philadelphia, Pa., will add November 1 a 10½ inch Plastering Trowel to the 10 and 11 inch sizes which he is now manufacturing. We are advised that this is a line of Trowels offered at an exceptionally low price. A circular relating to the goods will soon be issued.

Bissell Carpet Sweeper Company and Plumb & Lewis Mfg. Company, Grand Rapids, Mich., unite in an announcement to the trade of an increase in the paid up capital of the Bissell Carpet Sweeper Company to $300,000, and a combination of the interests of that company with the Plumb & Lewis Mfg. Company. The latter will continue under the same name and the same management as heretofore, but it is stated that the line will be improved by all the needed Bissell features and devices. While maintaining a distinctiveness in style and name and features, the facilities and devices of both companies will be united in either line of goods to give their customers the most improved goods.

McIntosh, Huntington & Co., Cleveland, Ohio, are sending to the trade exceptionally interesting illustrations of their plan of business in the form of a card about 14 x 22 inches with metallic ends, arranged with a loop for hanging. It is devoted to three illustrations and a description of their establishment, which consists of two buildings. The entrance to the store is in the main building on Superior street front, Nos. 116 and 118, which has a frontage of 35 feet and is 150 feet deep, containing five stories and a basement. The second building, which runs through from Long street to Champlain street, is 165 feet deep. These two buildings being separated by Long street at their near ends, are connected with each other by bridges at each floor and by a tunnel under the level of the street. The illustrations show the Superior street and Champlain street fronts, also both buildings with one side wall away, exposing the arrangement of the several floors. The first floor and basement of the building fronting on Superior street are devoted to an open stock of all descriptions, from which their trade with manufacturing establishments, &c., is supplied. The entire second floor is given up to samples of the various articles carried by them, and in the front of this floor are their general offices. The balance of the building is devoted to storage, and the stock on each floor is classified as far as possible to facilitate getting out orders. In the second building, which fronts on Champlain street, all goods are received at the Long street entrance, and all orders are packed in this building, lowered by elevator to the Champlain street front, from which all shipping is done. With the exception of the space required for the receiving and packing departments, this entire building is devoted to storage of stock. In their buildings are about 75,000 square feet of floor space and about 20,000 lineal feet of shelving from 2 to 3 feet deep. They have something over 125 persons in all the various departments.

In their advertisement on page 69, H. A. & A. H. Warner, Bristol, Conn., illustrate their Loose Key Faucet and also call attention to Metal Key Faucets, for which they are headquarters.

The *Building Advertiser*, San Francisco, Cal., in a late edition gives a description of the Hardware business of Osborne & Alexander, of that city, in connection with which they publish a full page illustration of the Lacham Building, which is still considered one of the best in the city, although erected in 1887. Osborne & Alexander are now occupying a large portion of this building. Besides carrying a stock of general Hardware, they deal large in tools, implements and machines connected with many trades and industries. They carry in stock workshop machines, operated by foot and steam power, and are also representatives of the Shipman Engine Company, Boston, for the sale of their Coal Oil Engines, from 1 to 22 horsepower, adapted to both marine and stationary purposes. The firm is engaged in the design, construction and equipment of steam launches of sizes ranging from 18 to 75 feet in length. They also represent a number of Bicycle and Tricycle manufacturers. They have developed accessory to their business a large demand for books devoted to the mechanical trades and other important industries. Osborne & Alexander occupy a position of prominence in the business of the Pacific Coast, and are among the leading Tool houses in that territory.

Packard & Co., Greenville, Pa., dealers in Guns and Sporting Goods, issue for the trade only a special Gun Circular, containing illustrations and prices. The line of goods shown are Breech Loading Double Guns of various makes; Single and Double Barrel Muzzle Loading Guns, Floberts, Warnant System, and Winchester Rifles, Cartridge Belts, Gun Covers and Shooting Coats. They also print prices of ammunition.

John Merry & Co., No. 235 West Fifteenth street, New York, are distributing to the trade circulars relating to goods they handle. On one side of the card the announcement is made that they carry in stock Lion, Phenix and Antelope brands of Galvanized Iron, Black Sheet Iron and Corrugated Iron. A list is also given of other metal supplies. On the back of the card attention is directed to Leader Pipe and a price-list is presented.

The National Pulley Covering Company, Baltimore, Md., are making arrangements to establish a resident agency in New York.

Harrington Bros., dealers in Hardware, Paints and Oils, Pittsfield, Mass., have sold out their stock to Eleazer Williams, of that city, who will continue the business for the present at the old stand, in connection with his present store.

F. E. Myers & Bro., Ashland, Ohio, advise us that by the recent assignment they are now the sole owners of the Hay Tool patents heretofore controlled by L. Y. Myers, Canton, Ohio, under which Myers, Housel & Co., Canton, and the Myers Mfg. Company, Canal Dover, Ohio, have heretofore manufactured the goods. F. E. Myers & Bro. have thus the exclusive and sole control of all the Myers' Carriers, Tracks, Forks, &c., offered to the trade.

The Chicago Spring Butt Company, Chicago, Ill., have acquired the patents of the Scranton Door Hangers, formerly made by the Scranton Mfg. Company, and are prepared to give prompt attention to orders.

Under date September 25, it is announced that the copartnership heretofore existing under the firm name of Bolles, Kimball & Wilde, Boston, has been dissolved by mutual consent. Chas. H. Bolles and Geo. F. Wilde, under the firm name of Bolles & Wilde, will continue the business at the old stand, 93 and 95 Pearl street, Boston.

Tacks or Rivets.

In *The Iron Age* of September 25, 1890, a Hardwareman states that at his house they were using some Tacks in putting down carpets, and in each box was found "a Rivet almost as long as the paper, and weighing fully one-fourth as much as the Tacks." We don't see what the manufacturer wants to waste his good long Rivets for when some old piece of casting or a chunk of iron would have weighed just as heavy. There have been manufacturers who have put up short weights of Nails, keeping out 4 or 5 pounds from each keg; and others who do not get an amount of Barb Wire on a spool that would correspond with the marked weight. Retail Hardwaremen have been known to wet down the rope in the cellar each morning to increase its weight, and to take enough Nails out of the keg to allow them to be sold at 25 cents a keg less than the competitor's price. The kegs were of course nicely headed up again.

It is not right, and it does not pay. While it has been repeatedly said that a merchant could not be strictly honest and be successful, the saying does not make it true. While a merchant might not think of being dishonest in any of the ways mentioned, the temptation to make a slight misrepresentation to effect a sale, to promise the delivery of goods or the doing of a job to secure the trade, when he knows he cannot fulfill his promise, is too often yielded to. Some proprietors will look the other way while a clerk is doing a dishonest act, which they would scorn to do themselves. There is too often the disposition to keep the nickel in the crowded horse car, or not to return surplus change when an error has been made. Dishonesty in small things leads to questionable transactions in larger ones, and to a breakdown in character, which is a man's best capital. One who does not report goods that are over in a bill is capable of putting a brick in the old paper for the ragman, or of soaking hides in water and then salting them before weighing, or even of putting long Rivets in papers of Tacks.

What the Dealer Risks.

When a man purchases goods at your store and asks credit, says the *Western Merchant*, you either give it to him or you do not, according to the circumstances under which you may be doing business at the time.

If you are doing a credit business, and advance credit to him upon request, have you stopped to consider what are the risks you assume? We presume not. But to the extent to which you extend credit to a man you place your business interests in his power, without much redress. He offers you no security, save faith in his honor, which may be entirely untried. He engages to meet his obligations on no special day. He gives you no schedule of his affairs, as you are obliged to do when you seek credit. He simply presents a bold request for accommodation for goods. In other words, he uses your business as a means to live ahead of his income.

You assume, in the first place, that the man is honest. A comfortable assumption, but one often grievously disappointed. Then you assume that his affairs are prosperous, of which you can only make a valueless hazard. If he is honest and his affairs are in good condition, you must add the assumption that he will meet with no unexpected reverses, and that he and his family will remain living in good health. If this impossible condition could be continued, the misguided man who gets trusted might, in ages to come, succeed in getting enough together to pay his debts, but as it cannot be hoped for in this world of transition, he will—unless he reforms—die with unsettled obligations, which will be a source of trouble to his creditors and executors. The poor, defunct creditor—who, whatever his credentials, will probably not be able to secure credit in the next world—usually leaves no property to pay his debts with, and bequeaths only a heritage of misery and suffering for his wife and penniless children

Such is the unhappy fate of the impecunious debtor. And what of the creditor? Unless he is a man of unusual discernment in reading character, and with a very strong mind which permits him to refuse credit with suavity and decision, he will succeed in carrying on his business, perhaps, but only by yielding up the profits on his cash business—which should be added to his capital stock of investment fund—to make good the losses on his credit business. Is it worth while to do business with these men who get trusted, only to be obliged to pay for the privilege in the end? We think not.

Price-Lists, Circulars, &c.

The Lee, Clark, Andreesen Hardware Company, Omaha, Neb., issue a trade catalogue illustrating fall goods. The covers are white, on which colored inks are used in printing, producing a pleasing effect. The line of goods shown is very complete for the autumn trade, consisting of Axes, Saws, Scoops, Baskets, Huskers, Lamps, Oil Cans, Lanterns, Stove Goods, Never Break Hollow Ware, Meat Cutters, Wringers, Washers, Weather Strip, Skates, Butcher Knives, &c. They state that, anticipating a heavy fall business, large purchases have been made, and their stock in extent and variety is larger this season than ever; they are fully prepared to execute all orders at sight; that their increased facilities and rapid system of handling orders enables them to guarantee the quickest possible shipments. They also call attention to their large stock of Guns, Ammunition, &c.

The Massachusetts Arms Company, Chicopee Falls, Mass., issue an illustrated and revised catalogue of the Maynard Rifle with interchangeable barrels, in calibers from 22 to 50, as manufactured by them. The distinctive features of the Maynard Rifles, to which they call attention, are: Interchangeable barrels, simplicity, compactness, symmetry, accuracy, safety and durability. The stock can be detached from the barrel quickly, thus enabling them to be placed in a traveling trunk. The arrangement is described as such that it allows of having as many barrels of all the different calibers of Rifle and Shot barrels as may be desired, only one stock and breech piece being required for them all. The construction of the Rifles and the care taken in making them are also alluded to.

The Piqua Handle and Mfg. Company, Piqua, Ohio, send us a price-list of their goods. These consist of Buckeye Farming Tools, Steel and Malleable Garden Rakes, Ames' Bent Shovel, Spade and Scoop Handles, D and Long Handles, Bent and Finished Handles, Door Stops, Door Knobs, Drawer Pulls, Shutter Knobs, Chisel, File and Screw Driver Handles, Auger and Mallet Handles, and variety Turnings of every description. They advise us that the making of small Handles was started to use waste material, which became valueless to them on account of the use of natural gas, and this department has developed quite rapidly, especially in Door Stops. Automatic machinery has been introduced for the production of these and other small goods and special Turnings.

The Gendron Iron Wheel Company, Toledo, Ohio, issue an illustrated price-list of Velocipedes, Tricycles, Goat Sulkys, Express Wagons, Toy Barrows, Baby Carriages and Steel Runners for the same. They also state that they are thoroughly equipped for the manufacture of high grade Cycles, of which illustrations are given. They have recently added improved machinery.

Samuel C. Tatum & Co., Cincinnati, Ohio, issue an illustrated catalogue No. 10 under date September, 1890. This is devoted to Copying Presses and Stands, Book and Paper Racks, Letter Boxes, Ink Stands, Paper Weights, Ideal Copying Pad Baths, Catalogue Files, Grocers' Fixtures, Hardware Specialties, Pulleys, Hangers, etc. This catalogue is about double the size of last year's, and contains many new goods Attention is called to their new line of Copying Presses, also their Ideal Baths with white enameled lining.

The Plumb & Lewis Mfg. Co., Grand Rapids, Mich., Eastern branch 103 Chambers street, New York, manufacturers of Clothes Wringers and Carpet Sweepers, issue an illustrated circular descriptive of these goods, with price-list. We are advised that improvements have been made on their Carpet Sweepers, which have been adopted in all their Sweepers listing $22 and above, consisting in the main of enlarged dust receptacles, rings vulcanized direct to the wheels, as well as an improved dump, which, while durable, is easy to open. They also issue a circular to dealers, calling attention to the vital talking points, for the purpose of giving impetus to sales. Attention is directed to their combined Clothes Wringer and Bench, which is self-supporting when folded, the sales of which they assure us extend to Nova Scotia and Washington, as well as to Belgium, Germany, Australia and Argentine.

Manning, Bowman & Co., Meriden, Conn., and 57 Beekman street, New York, issue two special lists devoted one to Coffee Pots and the other to Covered Cookers. In Coffee Pots the Good Morning, Continental and International are shown of various material and finish. Pure white porcelain Steamer and Hot Air Cookers for oatmeal, wheaten grits, farina, rice, custards, fruits, oysters, &c., are referred to in the other list, the steam or hot air surrounding the porcelain jar in which the food is simmered or stewed in such a way as to retain all its nutriment and delicate flavors.

The Herendeen Mfg. Company, Geneva, N. Y., have issued the tenth edition of the illustrated catalogue of the Furman Vertical Water Tube Steam and Hot Water Heater. The catalogue proper comprises over 50 pages, and at the end are a large number of testimonial letters and references. Accompanying it is a copy of their large lithographed poster.

The Watertown Thermometer Company, Watertown, N. Y., manufacturers of Thermometers, Barometers, Hydrometers, &c., issue an illustrated catalogue and price-list of the goods manufactured by them. The catalogue contains over 100 new designs manufactured or handled by this company prior to one year ago. The point is made that all their Thermometers, with the exception of a very few imported styles, are made entirely at their own factory. From raw material they finish with their own machinery and labor every part of the instrument. They also allude to the fact that the clinical department receives the most careful supervision. Their catalogue is an interesting one and very creditable, indicating the extent of their assortment and their enterprise.

Lane Brothers, Poughkeepsie, N. Y., manufacturers of the Swift Mill for coffee, corn, spice, &c., Coffee Roasters, Lane's Self-Measuring Faucet, Lane's Barn Door Hangers, &c., issue a catalogue and price-list illustrating these goods. They also send circulars showing Lane's Patent Parlor Door Hanger, Lane's Patent Automatic Lock Tackle Blocks and Lane's Steel Barn Door Hanger and Track. The Parlor Door Hanger is alluded to as quite an innovation on the old established kinds, discarding the double wooden track for a single steel one, using steel for the hanger instead of cast iron, and a leather tread to make it noiseless. Although so different from others we are advised it is proving a great success.

A. Tredway & Son's Hardware Company, 465 to 471 Iowa street, Dubuque, Iowa, jobbers of Heavy and Shelf Hardware, &c., issue a fall circular of season goods illustrating Elbows, Coal Hods, Dampers, Stove Boards, Scoops, Baskets, Axes, Saws, Lanterns, Hay Knives, Corn Huskers, &c. This company are agents for Glidden Barb Wire, Buhl Can Stock, Hazard Powder, Anthony Wayne Washing Machines, Batchellor's Steel Goods and Buffalo Scales. To the trade they remark that the present market is stronger and more active in all Staple Hardware and especially in seasonable goods for fall trade. In anticipation of a largely increased fall business their purchases and stock are much larger than usual.

James McKay & Co., Pittsburgh, Pa., proprietors of the Iron City Chain Works, manufacturers of all kinds of Coil and Crane Chain, send a price-list of the same. Their Coil Chain is described as made of good Refined Iron and proof tested to about ½ and ⅝ that given for Crane Chain, which is made of double refined iron and tested to the amount on the list before shipping.

L. H. Mace & Co., 111 to 117 East Houston street, N. Y., manufacturers of Refrigerators, Woodenware, Children's Carriages, imported and domestic Toys, issue a toy catalogue and illustrated price-list for 1890, covering a very large variety of these goods. They also issue a wholesale catalogue of Refrigerators, Woodenware and Baby Carriages.

The Knoxville Car Wheel Company, Knoxville, Tenn., send us a blotting pad, formed of several sheets of colored blotting paper and one of thin celluloid, fastened together at both ends. The celluloid sheet is handsomely printed in colors and gold, with an engraving of their works in black. The whole forms a handsome advertising medium.

The Marietta Hollowware and Enameling Company, Marietta, Pa., send us their circular of prices of Plain, Turned, Tinned and Enameled Hollowware. They call attention to the fact that they have unsurpassed facilities for manufacturing Refrigerator Tanks and Cooler Wells of every description. These tanks and wells are lined with pure white enamel, odorless and tasteless, which is, as well as the enamel on covered ware, guaranteed to be free from all poisonous substances.

The McMullen Woven Wire Fence Company, Chicago, Ill., issue circular price-lists of the various kinds and styles of Fences manufactured by them. These are

adapted to many uses besides farm and garden use, a special pattern being shown for cemetery lots, with iron posts which go 2 to 3 feet in the ground, as required. They also send a book for carrying papers, made of strong paper, the outside of which is covered with illustrations and prices of their goods.

The John H. McGowan Company, 42 to 46 Central avenue, Cincinnati, Ohio, issue an 1890 revised list, No. 14, of Twin Lever Duplex Boiler Feed Pumps, to supersede all former Twin Lever lists. These feed Pumps are fitted with Brass Turret valve seats and valves, and metallic steam and water cylinder packing. They also send a revised price-list of Brass and Iron body goods, Pipe Fittings, &c., for steam, water and gas, Boiler and Engine Trimmings; Pipe cutting tools, engineers' and mechanics' supplies.

The Eagle Iron Foundry and Machine Works, Cincinnati, Ohio, of which the John B. Morris Foundry Company are proprietors, issue an 1890 catalogue and price-list, relating to Stove Repairs, Hardware Specialties, Builders' and Plumbers' Goods, Soft Gray Iron Castings, Iron Pump Curbs, &c., manufactured by them. The company are erecting a commodious four-story brick building at the corner of Court and Harriet streets, which will be completed about January 1, 1891, their present building being inadequate for the business.

Mansfield & Co., Pittsburgh, Pa., manufacturers of Brass Goods, Babbitt Metal, Natural Gas Supplies, Iron Pipe and Fittings, &c., issue illustrated circulars, descriptive of Gas Logs, Pet Hose Nozzles and Coke Oven Valves The Gas Logs are referred to as being made of indestructible material, from 16 to 24 inches long, and are adapted in the various styles to be placed in fireplace, without any change of the linings or walls.

Joseph Lay & Co., Ridgeville, Ind., manufacturers of Brooms, Brushes, Street Sweeping Rolls, Rattan, Brass, Steel Wire and Heavy Brooms of all kinds, also Casting and Molders' Brushes, &c., issue circulars descriptive of these goods. The above company advise us they have been pressed much ahead of their capacity, trade being exceptionally good.

John T. Henry, Hamden, Conn , manufacturer of Henry's Letter Clips, Bill Files, Postal Card Files, &c., issues illustrated price-list circulars of his Pruning or Sheep Toe Shears and New Tree Pruner. The Tree Pruner is described as commencing the cut at the upper part of the limb, instead of the under part, which is considered an advantage. Attention is directed to the simplicity of construction, great power, and the ease with which the branch to be cut is approached. The instrument is pushed to the limb, when the forked frame is intended to guide it to the cutting position. We are advised that last year's sales on Henry's Orange Shears, for gathering oranges, were very satisfactory, both in Florida and California.

The Warder, Bushnell & Glessner Company, Springfield, Ohio, sole manufacturers of the Champion Harvesting Machines, issue a pamphlet giving pictures of the Presidents, from Washington to Harrison, with the place and date of birth and death, also date of inauguration of each. A portion of the book is devoted to a description of the Champion Harvester, setting forth its peculiar advantages.

Wm. P. Myer, 17 to 23 East South street, Indianapolis, Ind., manufacturer of Elevator Buckets, Rain Water Cutoffs, Tinware, Patent Specialties and jobber of Stamped and Japanned Ware, issues a price-list and catalogue, No. 5. This illustrates Deep and Shallow Stamped Ware, Pieced Tinware, Japanned Ware, Housefurnishing Goods, Wire Goods, Granite Ware, &c. The catalogue contains over 70 pages, and is very complete in the line of goods it represents.

The Plymouth Cordage Company, Plymouth, Mass., manufacturers of Cordage and Binder Twine of every description, issue a price-list of these goods under date September 3, 1890. This list includes Manilla, American and Russia Hemp, Sisal and New Zealand Cordage.

The Pope Mfg. Company, 77 Franklin street, Boston, Mass., issue an illustrated catalogue and price-list for 1890 of their Columbia Bicycles. Their leading Mediums are represented with latest improvements and full explanation of their special features.

The Portland Stoneware Company, 42 Oliver street, Boston; factory, Portland, Maine, issue a revised catalogue and price-list, illustrating their Tiles, Terra Cotta Vases, Flue Linings, Chimney Tops, Grease Traps, Stoneware, &c. Claim is made that this Pipe will be found fully up to a high standard of excellence, attention being directed to its perfect shape, smoothness, hardness and great strength.

Wm. Stairs, Son & Morrow, 174 to 190 Lower Water street, Halifax, N. S., wholesale importers and dealers in Heavy and Shelf Hardware, Mechanics' Tools and Cutlery, under date August 1, 1890, issue an illustrated catalogue of over 200 pages, which is designed to assist merchants in selecting at their convenience such articles as they may require. The illustrations are numerous, and the book will doubtless be appreciated by those into whose hands it may fall.

The Murray Iron Works Company, Burlington, Iowa, issue a catalogue illustrating special machinery for butchers and packers, consisting of Choppers, Mixers, Stuffers, Tanking Outfits, Presses, Engines, &c. They also send a separate catalogue of architectural ironwork, covering a line of Columns, Lintels, Sill Plates, Sidewalk Lights, Stairways, Roof Crestings, &c. They call attention to the extent of the foundry and their large facilities for turning out architectural work.

Singer, Nimick & Co., Pittsburgh, Pa., manufacturers of Axles, Springs, Steel Tire and all descriptions of Steel, issue under date of August 15, 1890, a convenient folder containing a price-list of these goods.

The McKinnon Sash and Hardware Company, St. Catherine's, Ont., issue an 1890 catalogue and price-list of Valances, Buckle Loops, Leather Fenders, Leather Dashes, Curtain Lights, Knob Eyelets, Top Props, Whip Sockets, Knobs, Prop Nuts, Buggy Boots, Toe Rails, &c. Their aim, to make the best goods of their kind, is referred to, also the several changes made in their goods with this end in view since the last issue of their price-list.

J. Q. Maynard, 12 Cortlandt street, New York, issues a number of circulars of the goods which he represents. These are Elevators, Dumb Waiters and Hoists, Traveling Cranes, Overhead Railway, Coburn Steel Track, Leather Belting, Rolling Stepladders for high shelving, &c.

W. S. Hammond, Lewisberry, Pa., issues, under date September 1, 1890, a revised price-list of Hammond's Window Sash Springs, as manufactured by him. These Sash Springs are made in two styles, A and B, and two kinds of finish.

R. J. Douglas Company, Waukegan, Ill., manufacturers of Rowing, Canoeing, Sailing and Steaming Boats, issue a catalogue and price-list. They remark in the introduction that they believe their establishment turns out more than twice as many craft as any in the world, and this enables them to hold prices, to which comparison is invited with corresponding grades of work. The work is profusely illustrated, showing a large number and variety of Boats.

Berger Brothers, 237 Arch street, Philadelphia, Pa., issue a circular illustrating their patent Eave Trough Hangers. They can be adjusted to any fall or pitch, and have no cross bars to choke up or burst; the point is also made that ice cannot affect them.

The Manly Mfg. Company, Dalton, Ga. (removed from Philadelphia, Pa.), send us their catalogue of Bridge Railings, Iron Fences, Jail Work, Railroad Street Fences, Station Railings and Gates, rolling, sliding or lifting Foot Bridges, Roof Trusses, Columns and Brackets. They advise us that they have assumed the management of the Sawmill department of the old Dalton Foundry and Machine Works, and are having a satisfactory trade, covering a large territory in the South. They issue a separate circular devoted to this branch of the business, setting forth the advantages possessed by this class of machinery as manufactured by them.

Exports.

PER SHIP GREAT ADMIRAL, AUGUST 13, 1890, FOR MELBOURNE, AUSTRALIA.

By H. W. Peabody & Co.—4 cases Pumps, 2 cases Axles, 7 cases Axles, 75 cases Builders' Hardware, 12 dozen Wringers, 8 dozen Axe Handles, 6 cases Builders' Hardware, 22 cases Fire Arms, 28 packages Builders' Hardware, 10 dozen Forks, 400 pounds Horse Nails, 1 case Rivets, 18 cases Skewers, 1 case Drills, 1 case Wire Goods.

By W. H. Crossman & Co.—21 dozen Wrenches, 556 pounds Butts, 8 dozen Axes, 3 cases Builders' Hardware, 1 case Lamp Goods, 39 Lawn Mowers, 1 gross Graters, 3 gross Wrenches, 1 case and 2 barrels Lamp Goods, 2 cases Builders' Hardware, 14 Chucks, 1 dozen Wringers, 8 dozen Axes, 34 dozen Wrenches, 1 gross Oilers, 90 Blocks, 15 dozen Hog Rings, 7 cases Builders' Hardware, 50 sets Stocks and Dies.

By A. S. Lacelles & Co.—7 packages Lampware, 1 Saw, 3 dozen Braces, 3 dozen Hammers.

By William E. Peck.—11 Refrigerators, 12 Ice Cream Freezers, 8 Refrigerators.

By Meriden Britannia Company.—12 boxes and 1 cask Silver Plated Ware.

By H. B. Moore.—2 boxes Machinery, 6 cases Agricultural Machinery.

By W. K. Freeman.—2 boxes Platedware, 3 boxes Horse Nails.

By R. W. Cameron & Co.—6 cases Carriage Hardware, 20 dozen Scoops, 1 box Carriage Hardware, 1 case Brushes.

By McLean Bros. & Rigg.—4 dozen Bench Screws, 16 dozen Augers, 12 dozen Wrenches, 13 dozen Saws, 20 dozen Hatchets, 27 Plows, 36 dozen Hammers, &c., 2 sets Whiffletrees.

By R. W. Cameron & Co.—1700 Bolts, 21 sets Axles, 8 packages Hardware, 1 case Platedware, 18,000 sheets Manilla Paper, 1¼ dozen Graniteware, 18 dozen Glue, 6 packages Hardware, 13,000 Cartridge Shells.

By Dunbar, Hobart & Co.—7840 pounds Nails.

By Russell & Irwin Mfg. Company.—1 case Hardware.

By Welsh & Lea.—14 cases Hardware, 1 case Rakes, 6 cases Axle Grease, 3 cases Axes, 1 case Casters.

By Strong & Trowbridge.—18 packages Stoves.

By L. Gershel & Bro.—30,000 Metallic Cartridges.

By Healy & Earl.—15 cases Mill Machinery, 2 cases Wood Working Machinery.

By H. Disston & Sons.—4337 pounds Hardware.

By W. & B. Douglas.—2 casks Pumps.

By Joseph Dixon Crucible Company.—1470 pounds Crucibles.

By Plumb, Burdict & Barnard.—12,300 pounds Bolts.

By Sargent & Co.—17 cases Hardware.

By L. D. Crossmond & Co.—2187 pounds Agricultural Implements.

By J. L. Mott Iron Works.—3109 pounds Cast Iron Stoves.

PER BARK VERITAS, SEPTEMBER 3, 1890, FOR PORT ELIZABETH, SOUTH AFRICA.

By W. H. Crossman & Bro.—1 dozen Shellers, 1 case Plow Parts, 10 dozen Handles, 1 gross Fruit Jars, 360 feet Rubber Hose, 4

cases Hardware, 5 cases Rat Traps, 25 dozen Oil Stones, 3 dozen Bench Screws, 1 dozen Sad Irons, 2 dozen Meat Choppers, 1 case Hardware, 18 dozen Hoes, 1 case Hardware, 1 dozen Ladders, 16 packages Road Scrapers, 1500 pounds Nails, 60,000 pounds Metallic Cartridges, 153 cases Agricultural Implements and parts, 40 dozen Hardware, 30,000 pounds Barb Wire, 5 dozen Forks, 6 cases Hardware, 4 dozen Hoes, 4360 pounds Sash Weights, 11½ dozen Sash Cord, ½ dozen Wringers, ½ dozen Plow Parts, ½ dozen Churns, 7 cases Wagons, 1 case Tinware, 7000 pounds Barb Wire, 5½ dozen Scales, 525 pounds Sisal Rope, 3500 pounds Nails, 16 cases Hardware, 2 Wagons, 6 cases Agricultural Implements, 25 pairs Axles, 5 cases Agricultural Implements, 6 Carriage Springs, 5 pairs Axles, 1 crate Money Drawers, 12 cases Fruit Parers, 4 gross Fruit Jars, 4 cases Agricultural Hardware, 1 dozen Sausage Stuffers, 2 dozen Carriage Springs, 40,000 pounds Barb Wire, 6000 pounds Nails, 7089 pounds Manilla Rope, 2395 pounds Sisal Rope.

By John Norton & Son.—460 pounds Road Carts.

By Oelrichs & Co.—10 dozen Axes.

By Alfred Field & Co.—1½ dozen Scales, 1 dozen Fire Arms.

By Corner Bros. & Co.—20 doxen Axes, ½ dozen Sledges.

By Winchester Repeating Arms Company.—42 Guns, 26,000 Cartridges.

By Corner Bros. & Co.—216 Plows.

By Coombs, Crosby & Eddy.—15 dozen Axes, 50 dozen Hatchets, 2 dozen Parers, 50,000 pounds Barb Wire, 48 Plows, 585 pounds Shears, 9 dozen Hatchets, 766 pounds Plows.

FOR EAST LONDON.

By Coombs, Crosby & Eddy.—4½ dozen Platedware, 5665 pounds Plow Parts, 10,242 pounds Barb Wire, 1 case Sash Weights and Cord, 8 dozen Axes, 9 dozen Wrenches, 1½ gross Coat and Hat Hooks.

By W. H. Crossman & Bro.—50 dozen Hardware, 20 cases Agricultural Implements, 1 case Hardware, 250 pounds Horse Nails, 20 dozen Stoves, 7000 pounds Nails, ½ dozen Scales, 312 packages Agricultural Implements.

REVIEW OF THE WHOLESALE MARKET IN PAINTS AND OILS.

It should be understood that the prices quoted in this column are strictly those current in the wholesale market, and that higher prices are paid for retail lots. The quality of goods frequently necessitates a considerable range of prices.

Paints and Colors.

The general distribution has been of routine character, with the aggregate in line with what is customary at this season and little change in the general situation. High cost of Pig Lead and consequent high prices for the Pigments, along with absence of any signs of cheaper Linseed Oil, serve to impart more or less firmness to values of Leads of all descriptions and ready-mixed house Paints. The cost of Colors is also in many instances at a point that has more or less influence upon values of a considerable line of goods. During the past week there have been no important changes except on Quicksilver Vermilion, for which 2½¢ advance is quoted.

White Lead.—The cost of crude material used in the manufacture of this pigment has undergone a further considerable advance, but corroders have made no change in their figures. From some New England points reports have been received of alleged "cutting" of list prices by manufacturers identified with the National Lead Trust. Officials of the combination deny that there is any truth in the allegation, however, and have gone to the extreme of offering a financial consideration for proof of any departure from the list. Local Jobbers state that they have no reason to believe that the trust has directly or indirectly countenanced irregularities. Outside competition figures with no prominence as far as pure White Lead is concerned, and the tendency of prices for the adulterated article has been in the direction of a higher level. Several brands of the latter, as a matter of fact, are selling at ¼¢ @ ½¢ ₱ lb advance over the prices current a few weeks ago. The distribution at present is of merely routine character and the demand moderate.

Red Lead and Litharge.—There has been no deviation from list prices for either of these pigments and the market is firm, with a full average distribution going on.

Zincs.—Prices for American Oxide have been advanced ½¢ ₱ lb, owing to moderate supply and high cost of crude material. The lowest grade is now quoted at 4½¢, and others at from 4½¢ up to 5¢. Orders continue to come in rather slowly but the distribution is of sufficient volume to keep supplies in favorable position. Foreign brands are very firm at former, prices, but not selling except in moderate quantities.

Colors.—Owing to the enhanced cost of Quicksilver, manufacturers of Quicksilver Vermilion have advanced their prices 2½¢ ₱ lb, making the range 77½¢ @ 82½¢, according to size of order. The imported article is also higher. Apart from this there have been no changes in either house painters' or grinders' Colors, but the general market is firm, although rather quite.

Miscellaneous.—Block Chalk, to arrive, is quoted at $2.50 @ $2.65, ex-vessel. The demand at present is moderate, and high freights, rather than trade wants, govern values. Whiting is selling at old prices, and to a fair extent. There is no particular change on Paris White or on Clays, the demand for which at present is moderate.

Oils and Turpentine.

Quite heavy transactions in crude Menhaden and crude Sperm Oils, and a reduction in the price of Olive Oil in barrels, consequent upon the latter being placed on the free list, cover about the only really new features for the week under review. There has been very little movement in prices of other Oils, at all events, and neither transactions nor negotiations have exceeded ordinary bounds. The present situation is devoid of conditions pointing to any unusual movement of supplies or radical changes in prices in the immediate future.

Linseed Oil.—Prices of seed have depreciated somewhat, but the cost of the crude material is still relatively higher at the present time than it was a month ago, and nothing has transpired in the way of competition between local and outside manufacturers to unsettle values. Occasionally a lot of out of town product comes in and is disposed of at 59¢, but anything under 60¢ is strictly exceptional. City pressers hold their prices firmly at 62¢ for domestic seed product and 64¢ for Oil made from Calcutta seed. The distribution is of about the usual volume.

Cotton Seed Oils.—Crude Oil has been selling to a very fair extent at 26¢ for prime old and 27¢ for prime new, or practically the same prices that ruled at the beginning of the month. Refined is steady at prices on the basis of 32¢ @ 33¢ for prime Summer Yellow, and in fair request. Production is going ahead on a large scale and present indications are that low prices will rule for some time to come.

Menhaden Oils.—A line of about 5000 barrels crude Oil, Maine product, has been sold during the week, and supplies in first hands are again cut down to a low point. The catch of fish continues very fair, however, and values have not changed materially. The Pressed and Bleached Oils are selling at old prices and to a moderate extent only.

Sperm Oils.—Upward of 1200 barrels crude have been sold in the New Bedford market, and since that movement prices have been marked up 2¢ @ 3¢ ₱ gallon. This rise has served to stiffen the market for the manufactured products. The latter, in fact, are held at 1¢ @ 2¢ ₱ gallon advance.

Lard Oil.—There has been practically no change the past week. Present make prime, whether city or out of town make, sells at 51¢, and other grades at proportionate prices. The movement is fair.

Miscellaneous.—Owing to the placing of the article on the free list prices for Olive Oil in barrels have been reduced to 72¢ here. Cocoanut, Palm and Red Oils are firmly held. In the respective lines there has been merely the routine business.

Spirits Turpentine.—The market has gradually improved during the past week under the influence of rather better local demand and stronger advices from the South. Prices are very steady now at 41¢ @ 41½¢, according to style of package.

CONTENTS.

Triple Screw Steel Protected Cruiser No. 12. Illustrated 565
Triple Screw Propulsion 568
New England Notes 569
Virginia Iron Notes 569
Convention of the Iron and Steel Institute. 570
American Meeting of the Iron and Steel Institute:
- Development of American Blast Furnaces 571
- Bessemer Gold Medal 583
- Fuel Gas and Its Applications. Illus. 585
- Notes on the Bessemer Process 588
- Aluminum Steel 589
- Welding by Electricity 589
- Wear of Metal 591
- Iron Development and Ore Resources of Virginia 593
- The Holley Memorial 597

The Joplin Ore Fields 598
Editorials:
- Reciprocity Treaties 599
- Lake Shipments 599
- Sheets for Tin Plate 599
- Shortage of Cars 600

Manufacturers of Iron and Steel Sheets 600
Washington News 601
Bar Iron Extras 602
Lake Shipbuilding 602
New Publications 603
Southern Miscellany 603
Manufacturing: Iron and Steel, Machinery, Hardware, Miscellaneous 604, 605
The Week 605
Trade Report: Chicago, Cincinnati, Chattanooga, Philadelphia, St. Louis, Detroit, Cleveland, New York, Metal Market, New York Metal Exchange, Financial, Imports, Coal Market, Pittsburgh, British Iron and Metal Markets 606-610
The Dangers of Electricity 611
Steamships on the Pacific 611
Hardware: The Condition of Trade, Barb Wire, Wire Nails, Cut Nails, Miscellaneous Prices, Scythe Lists, Items, Tacks or Rivets, What the Dealer Risks, Price-Lists, Circulars, &c., Exports 612-617
Review of the Wholesale Market in Paints and Oils: Paints and Colors, Oils and Turpentine 618
The Famous Self-Heating Plumbers' Stove. Illustrated 619
The Straining Buck Saw. Illustrated 619
The Fort Madison Columbia Manure Fork. Illustrated 619
Yale Adjustable Coat Hooks. Illustrated 619
Burglar Proof Sash Locks and Ventilators. Illustrated 620
Merwin & Hulbert's Hinge Pistol. Illus. 620
The Ratchet Wrench and Ratchet Drill. Illustrated 620
The Yale Screw Sash Fast. Illustrated 621
The Safety Automatic Hitching Strap. Illustrated 621
The Standard Coat and Hat Hook. Illus. 621
The Standard Screw Driver. Illustrated 621
Current Hardware Prices 622-628
Paints, Oils and Colors 6 8
Current Metal Prices 629

The Famous Self-Heating Plumbers' Stove.

The Famous Mfg. Company, 1214 Pine street, St. Louis, Mo., are introducing the Famous Self-Heating Plumbers' Stove, as illustrated herewith. The manufacturers reccommend these plumbers' stoves as absolutely safe, durable and simple of construction. They state that, unlike other plumbers' stoves, which are made of thin

The Famous Self-Heating Plumbers' Stove.

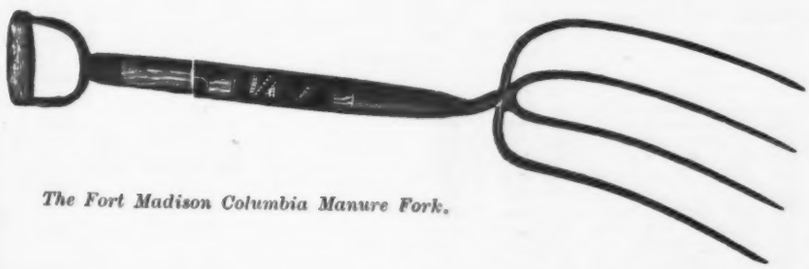
sheet metal with soldered or brazed joints, this stove is of heavy cast brass throughout, put together in a most perfect manner. It does away with air pumps, and the points are made that it requires no repairs of leakages, and that it does better work in less time and with less fuel than other stoves.

The Straining Buck Saw.

The Sip Mfg. Company, Jersey City, N. J., are putting on the market the Straining Buck Saw, as illustrated herewith. By the use of the lever the saw blade can be made perfectly tight in an instant, and as quickly made slack, thus releasing all

The Straining Buck Saw.

strain on the frame when not in use. Should the frame lose its elasticity the lever can be moved from the first hole to the next, and so on. The stretcher wires can be moved to a lower notch on the wedge-shaped irons should the limit of the holes be reached, which will again give a large straining capacity. This expedient will, however, rarely have to be resorted to. There are no mortises cut in the frame, as the iron sockets holding the cross piece are held in place by pins cast on the sockets and driven into the end pieces of the frame, thus making it stronger than the old style. It will also be noticed that the end piece by which the saw is held when in use extends above the stretcher, allowing for a hand hold there if desired. All the iron work is malleable and enameled black. The advantage of quickly straining or releasing the frame over the slower process with a small screw thread is obvious; most persons finding it takes too much time to unscrew the stretcher, and leave the frame in a strained condition, and with continued tightening, the frame finally breaks. These frames are manufactured of maple or ash, oil finished.



The Fort Madison Columbia Manure Fork.

The Fort Madison Columbia Manure Fork.

The Iowa Farming Tool Company, Fort Madison, Iowa, are putting on the market the Columbia Manure Fork, illustrated herewith. Points of excellence referred to are: That it is perfectly balanced; has an elegant and graceful hang, resulting from the curved shank, and has no clumsy ferrule end and cap for dirt or other matter to cling to. It is their Champion pattern, with curved shank and heavy socket. The handle being straight makes it a simple matter to replace when broken.

The acquistion of two coaling stations, one at Samoa and the other at Pearl River, in the Sanwich Islands, is the beginning of a system that must become widely extended, to provide facilities for the movements of United States naval cruisers and merchant steamers. The completion of the Nicaragua Canal will enhance the value of both of these, but thus far their possession has been of little advantage. Negotiations for stations in Samona Bay, in San Domingo, and at the Mole St. Nicolas, in Hayti, came to nothing. Secretary Chandler recommended additional stations at Curacoa, in the Caribbean Sea; Santa Catharina, in Brazil; the Straits of Magellan; La Union, in Salvador, or Amapala, in Honduras; Tullear Bay, in Madagascar; Monrovia, in Liberia; the Island of Fernando Po, and Port Hamilton, in the Nan-how Islands of Corea. The necessity for renewing the recommendations will become more obvious.

Yale Adjustable Coat Hooks.

The Yale & Towne Mfg. Company, Stamford, Conn., are introducing Adjustable Coat Hooks, as illustrated herewith.

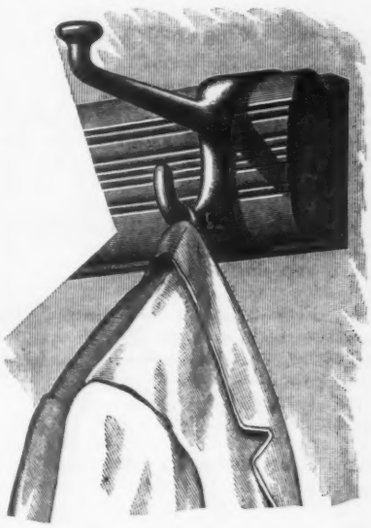


Fig. 1.—Adjustable Coat and Hat Hooks.

Instead of being fastened permanently to the woodwork, the Yale Hooks are made with bases curved to fit a special form of molding. The molding, which may be either plain or ornamented, is permanently attached to the wall or ceiling, and the hooks slipped on in any desired number;

Fig. 2.—Adjustable Hooks for Wardrobes or Closets.

or a small piece being cut out of the lower edge of the molding, hooks may be added at any time. Fig. 1 shows the hooks intended for side walls, while Fig. 2 is designed for ceilings.

Burglar Proof Sash Locks and Ventilators.

The J. G. Jenkins Mfg. Company, Oswego, N. Y., are introducing Burglar Proof Sash Locks and Ventilators, as illustrated herewith, in various styles. The principle upon which these locks are constructed and operated is the same in all, being one bolt for each, the upper and lower sash, with concealed springs, operated by push pins or buttons on the window stop, the face plate being the only part of the lock which is exposed to view. These locks are adapted for windows with or without weights. Fig. 1 shows the Economy lock with the stop removed, exposing the manner of application and the working parts. Figs. 2 and 3 show the Perfection lock, also the process of locking and unlocking. By pressing the knob in and turning it to the right, as in Fig. 3, the bolt is locked back. Now by drawing the knob out and turning it to the right the window is securely locked. A glance will show whether the pin is in and the bolt locked back. Should the window be open any less than the second hole, say 6 inches, the window is safe. Windows can be always closed without handling the lock. The manufacturers state that they know of no condition in which a sash is used which these locks do not fully and completely provide for; also that their simplicity, automatic action, strength, ventilating qualities and adaptability to various thicknesses of sash render them desirable. The point is made that they lock either or both sash securely in any position desired, thereby affording the means of perfect ventilation; also absolute security against burglars and sneak thieves. These locks are also adapted to any style of blind or screen. The locks were awarded the highest bronze medal for superiority at the fair of the American Institute held in New York City in 1888, also the medal prize at the Piedmont Fair, Atlanta, Ga., in 1889.

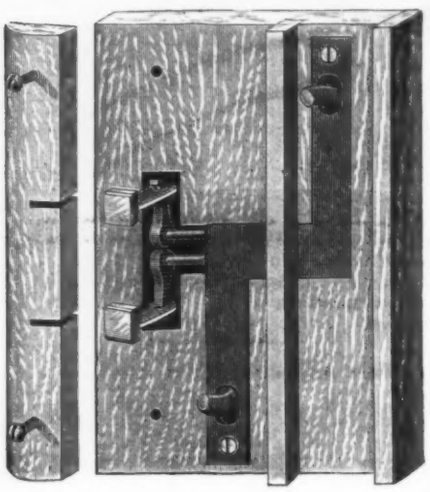


Fig. 1.—No. 121 Economy Sash Lock and Ventilator.

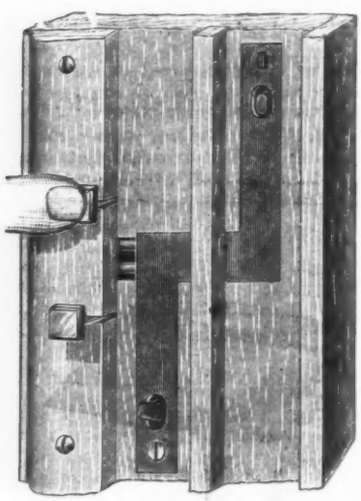


Fig. 2.—No. 31 Perfection Burglar Proof Sash Lock and Ventilator.

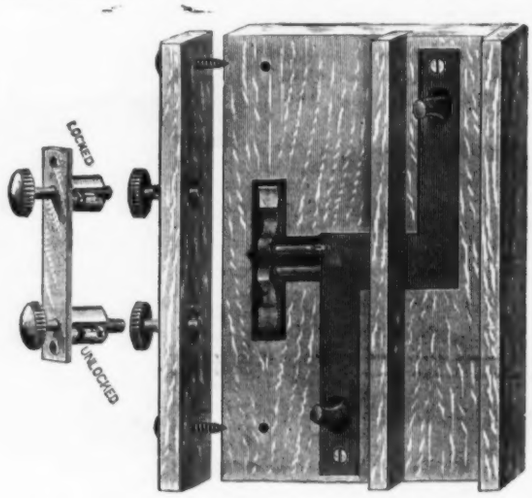


Fig. 3.—No. 31 Perfection Lock with Stop Removed.

Merwin & Hulbert's Hinge Pistol.

Merwin & Hulbert, 26 West Twenty-third street, are putting on the market a Hinge Pistol as illustrated herewith. This pistol differs from others in that it weighs but 11 ounces, and is built on a small frame, five shots, 32 caliber, which is the most desirable size through the East, and rapidly increasing through the West. The manufacturers advise us that on the market there are tip up ejecting pistols of the Smith & Wesson pattern, but on a frame the size of the Smith & Wesson 38 caliber, both in 32 and 38 caliber. The manufacturers allude to the finish and quality of these goods in connection with the moderate price at which they are offered as insuring a large sale. Especial attention is called to the fact that nearly all bullets of central fire cartridges are lubricated on the inside of the shell, leaving the outside surface perfectly smooth. To prevent the cartridges from slipping out of the cylinder, all of Merwin & Hulbert's XL Double Action Revolvers have a spring gate before the loading aperture.

Merwin & Hulbert's Five Shot Self Ejector Revolver.

The Anglo-American Packing House in Chicago, owned by Fowler Bros. was damaged by fire to the extent of $400,000. An English syndicate purchased the plant and good will, and the new company was to be called the Fowler Bros., Limited. It was incorporated in England with a capital stock representing $4,383,000. The origin of the fire is not explained.

The Ratchet Wrench and Ratchet Drill.

Clarence Kemp, Baltimore, Md., is introducing a combined ratchet wrench and ratchet drill, as illustrated herewith. It is referred to as being made entirely of steel and adapted to a large range of uses. Among these are enumerated the tightening and loosening of nuts, set screws, &c., in close or inaccessible places and for overhead work, and it is further stated that in any position it is preferable to an ordinary wrench. The sockets will fit either square or hexagon nuts, and the wrench works either to the right or left. These tools are made in three sizes, with sockets to take from ¼ to ⅝ inch.

The Climax Ratchet Wrench and Ratchet Drill.

The Yale Screw Sash Fast.

The Yale & Towne Mfg. Company, Stamford, Conn., are introducing a screw sash fast, as illustrated herewith. As shown in Fig. 1, it consists of a pivoted screw, swinging in a vertical plane, and attached by a neat base to the upper sash. A spring knuckle under the foot of the screw holds it in a vertical position when not clamped, and prevents all possibility of leaving it in a position which could interfere with the movement of the lower sash. The socket for the screw is fastened to the top of the lower sash, and when the window is closed the screw is pulled into the inclined position in the socket and the milled thumb-nut tightened until the fastening is secure. The screw sash fast is shown in both positions in Fig. 2, and its construction and operation are so simple as to require no further description. The manufacturers call attention to the following points of excellence embodied in this sash fast. That it cannot be opened from without, except by first breaking the glass; that it draws the sashes very firmly together; that it remains in the position in which it is placed when open; that it has no objectionable projections, and is most simple and convenient in operation.

Fig. 1.—Yale Screw Sash Fast.

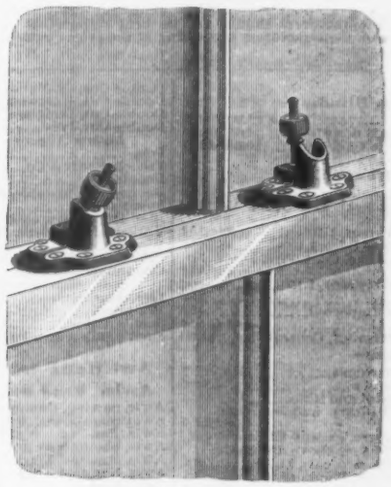


Fig. 2.—The Screw Sash Fast in Both Positions.

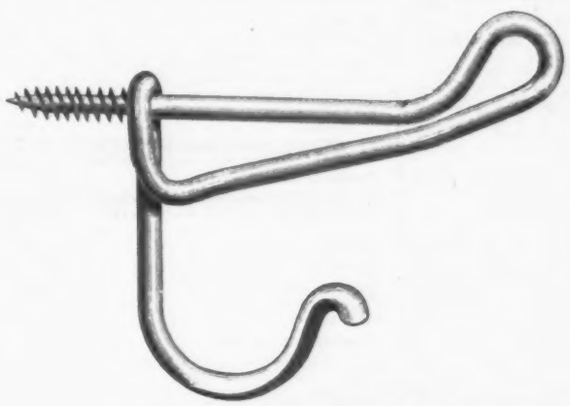
The Safety Automatic Hitching Strap.

Brittan & Bond, 154 Lake street, Chicago, Ill., are manufacturing an automatic Hitching Strap, as illustrated herewith. It consists of a tinned malleable iron drum, inclosing steel spring, with a heavy oak leather strap, attached to the spring by tinned snap and ring. These are packed in a pasteboard box, with blind screws for attaching. The design of the invention is a hitching strap that will adjust itself to the requirements of a horse, allowing him to lie down comfortably and to shorten when he gets up, preventing the possibility of his being thrown by getting his foot over the strap. The manufacturers claim that it is very strong, cannot get out of order, and will wear as long as there is a manger to fasten it to.

The Safety Automatic Hitching Strap.

The Standard Coat and Hat Hook.

The Hamblin & Russell Mfg. Company, Worcester, Mass., are introducing a wire coat and hat hook, as illustrated herewith. It will be noticed that the screw portion is the rolled thread screw of the American Screw Company, of which we have already given a description. The manufacturers call attention to the points of excellence in the hook, which are that the improvement of the rolled thread strengthens the hook at least one-half, as it is not cut away at the weakest point, the thread being two sizes larger than the wire itself; that the superior point enables it to enter the wood straight and easily; that the deep thread has more holding surface than any other; that it will enter hard wood without boring; that being made of tough material it will never break, and that the wide swedged lower hook being four sizes broader than the wire itself adds strength and a wide flat surface for garments to hang upon. The moderate price at which this hook is offered is also alluded to.



The Standard Coat and Hat Hook.

The Standard Screw Driver.

The Chantrell Tool Company, Reading, Pa., John H. Graham & Co., 113 Chambers street, general agents, are introducing the Standard Screw Driver as illustrated herewith. The blades are described as being forged from the best steel, finely finished, and each one is thoroughly tested and inspected. The blades are warranted not to work loose. The handles are mahogany finished, and referred to as finely polished. It is intimated that the prices are low at which these screw drivers are offered, considering the grade of goods. The company own the patent on the shank of this driver, which has been recently issued to their superintendent, N. J. Poindexter.

The Standard Screw Driver.

Steps are being taken looking to the organization of a union insurance company in the Connellsville coke region. The movement was inaugurated by Thomas Lynch, general manager of the H. C. Frick Coke Company, Mr. Lynch recently held a conference with some officials of the Knights of Labor organization, and offered to contribute $2000 to start the organization, and also to pay $100 for the loss of life of any of their employees. If organized, the new association will be affiliated with and be under the exclusive control of the Knights of Labor, although any miner will be allowed to join it. There will be monthly dues and assessments and a board of directors elected annually.

CURRENT HARDWARE PRICES.

OCTOBER 8, 1890.

Note.—The quotations given below represent the Current Hardware Prices which prevail in the market at large. They are not given as manufacturers prices, and manufacturers should not be held responsible for them. In cases where goods are quoted at lower figures than the manufacturers name, it is not stated that the manufacturers are selling at the prices quoted, but simply that the goods are being sold, perhaps by the manufacturers, perhaps by the jobbers at the figures named.

Adjusters, Blind.

Domestic.....₱ doz $3.00, 33⅓%
Excelsior.....₱ doz $10.00.....50&10&2%
Washburn's Self-Locking.....20&20&10%

Ammunition.—

Caps, Percussion, ₱ 1000—
Hicks & Goldmark's and Union Metallic Cartridge Co.
F. L. Waterproof, 1-10's.....34@35¢
E. B. Trimmed Edge, 1-10's.....46@48¢
E. B. Grnd. Edge, Cent. Fire, 1-10's.....46@47¢
Musket Waterproof, 1-10's.....50¢
G. D.....28¢
S. B. Genuine Imported.....45¢
Eley's E. B.....54¢ @ 55¢
Eley's D Waterproof, Central Fire...$1.60

Cartridges—
Rim Fire Cartridges.....50&5&2 %
Rim Fire Military.....15&2 %
Cent. Fire, Pistol and Rifle.....25&5&2 %
Cent. Fire, Military and Sporting 15&5&2 %
Blank Cartridges, except 22 and 32 cal., additional 10 % on above discounts.
Blank Cartridges, 22 cal., $1.75..... 2 %
Blank Cartridges, 32 cal., $3.50..... 2 %
Primed Shells and Bullets.....15&5&2 %
B. B. Caps, Round Ball, $1.75..... 2 %
B. B. Caps, Con. Ball, Swgd., $2.00..... 2%

Primers—
erdan Primers, $1.00..... 2%
B. L. Caps (for Sturtevant Shells) $1.00, 2%
All other Primers, $1.20..... 2%

Shells—
First quality 4, 8, 10 and 12 gauge 25&10&2%
First quality, 14, 16 and 20 gauge ($10 list).....30&10&2%
Prize.....40&2%
Star, Club, Rival and Climax brands, 33⅓&10&2%
Setbold's Comb. Shot Shells.....15&2%
Brass Shot Shells, 1st quality..... 60&2%
Brass Shot Shells, Club, Rival, Climax.. 65&2%

Shells Loaded—
Standard List, July 19, 1890..40&10&5%

Wads—Price per M.
U.M.C.&W. R. A.—B. E., 11 up... 68¢
U.M.C.&W. R. A.—B. E., 9&10.. 82¢
U.M.C.&W. R. A.—B. E., 8..... 96¢
U.M.C.& W.R. A.—B. E., 7..... $1.10
U.M.C.&W. R. A.—P. E., 11 up.. 1.15
U.M.C.&W. R. A.—P. E., 9&10.. 1.50
U.M.C.&W. R. A.—P. E., 8..... 1.70
U.M.C.&W.R. A.—P. E., 7..... 1.80
Dis.30&3
Eley's B. E., 11 up.....$1.75
Eley's P. E., 11@20..... 2.80

Anvils.—

Eagle Anvils, ₱ ₤ 10¢.....15@15&5%
Peter Wright's..... 11¼¢
Armitage's Mouse Hole.....10¼¢
Armitage's Mouse Hole, Extra...12 x 1¼"
Trenton.....9½@10¢
Wilkinson's.....9¾@10¢
Moore & Barnes Mfg. Co.....33⅓%

Anvil Vise and Drill—
Millers Falls Co., $18.00.....20%
Cheney Anvil and Vise.....25%
Allen Anvil and Vise, $3.00.....40&10%
Star.....45&5 %

Apple Parers—See Parers, Apple, &c.

Augers and Bits—

Douglass Mfg. Co.
Wm. A. Ives & Co.
Humphreysville Mfg. Co.
French, Swift & Co. (F. H. Beecher,..
P. S. & W. Co.
Rockford Bit Company.
Cook's, Douglass Mfg. Co.....55 %
Cook's, N. H. Copper Co.50&10&50&10&5%
Ives' Circular Lip.....60%
Patent Solid Head.....30%
C. E. Jenning & Co., No. 10, extension lip.....40%
C. E. Jennings & Co., No. 30.....60%
C. E. Jennings & Co., Auger Bits, ₱ set, 32½ quarters, No. 5, $5; No. 30, $3.50.20%
Lewis' Patent Single Twist.....45%
Russell Jennings' Augers and Bits.25&10%
Imitation Jennings' Bits.....60&30&5%
Snell's Jennings Pattern.....60%
Pugh's Black.....20%
Rockford, Jenning's Pattern.....60%
Car Bits.....60@60&10%
Car Bits, P. S. & W. Co.....60&10%
Snell's Car Bits.....60%
L Hommodieu Car Bits.....15&10%
Forstner Pat. Auger Bits.....10%
Cincinnati Bell-Hangers' Bits....30&10%

Bit Stock Drills—
Morse Twist Drills .....50&10&5%
Standard.....50&10&5%
Cleveland.....50&10&5%
Syracuse, for metal.....50&10%
Syracuse, for wood (wood list).30@30&5%
Williams' or Holt's, for metal.50&10&10%
Williams' or Holt's, for wood.. ..40&10%
Cincinnati, for wood.....30&10%
Cincinnati, for metal.....45&10%

Expansive Bits—
Clarks' small, $18; large, $26 .35@35&5%
Ives' No. 4, ₱ doz $60.....40%
Swan's 40%
Steer's, No. 1, $26; No. 2, $22.....35%
Stearns' No. 2, $48.....20%

Gimlet Bits—
Common .....₱ gross $2.75@$3.25
Diamond.....₱ doz $1.10.....25&10%
Bee.....25@25&5%
Double Cut, Shepardson's.....45@45&10%
Double Cut, Ct. Valley Mfg. Co ...30&10%
Double Cut, Hartwell's, ₱ gro.....$5.25
Double Cut, Douglass' .....40&10%
Double Cut, Ives'..... .....60@60&10%

Hollow Augers—
Ives .....
French, Swift & Co.....
Douglass' .....
33⅓@ 33⅓&10%
Bonney's Adjustable, ₱ doz $48....40&10%
Stearns' .....20&10%
Ives' Expansive, each $4.50.....50&5%
Universal Expansive, each $4.50.....20%
Wood's .....25@25&10%
Cincinnati Adjustable.....25&10%
Cincinnati Standard.....25&10%

Ship Augers and Bits—
L'Hommedieu's.....15&10@15&10&5%
Watrous'.....15&10@15&10&10%
Snell's .....15&10@15&10&5%
Snell's Ship Auger Patt'n Car Bits, 15&10@15&10@5%

Awl Hafts—See Hafts, Awl.

Awls, Brad Sets, &c—

Awls, Sewing, Common ₱ gr $1.70, 35%
Awls, Should. Peg, ₱ gr $2.45, 40@40&10%
Awls, Pat. Peg...₱ gr 63¢.... 40@40&10%
Awls, Shouldered Brad..2.70 ₱ gr.....35%
Awls, Handled Brad...$7.50 ₱ gr.....45%
Awls, Handled Scratch ₱ gr, $7.50.35&10%
Awls, Socket Scratch, ₱ doz, $1.50.25&30%

Awl and Tool Sets—See Sets, Awl and Tool.

Axes—

	Plain.	Beveled.
First quality	$8.00	$8.50
Others	7.50	8.0(

Axle Grease—See Grease, Axle.

Axles—

No. 1, 4½@5¢, No. 2 5½@6½¢
Nos. 7 to 14.....55&5%
Nos. 15 to 18.....47½% } 3 % cash
Nos. 19 to 22 .....70%
Concord Axles, loose collar.....5¢@6¢
Concord Axles, solid collar.....6¢@7¢
National Tubular Self-Oiling..... 33⅓%@33⅓&5%

Bag Holders.—See Holders, Bag.

Balances—

Spring Balances 40%

	No. 2000	20	30
Chatillon, ₱ doz.....	$0.80	0.95	1.75 net

Chatillon Straight Balances.....40%
Chatillon Circular Balances.....50&10%

Bars.

Crow—
Cast Steel.....₱ ₤ 4¼¢
Iron, Steel Points..... ..₱ ₤ 3¾¢

Basins, Wash—

Standard Fiberware, No. 1, 10½ inch, $2; 12-inch, $2.25; 13½-inch, $2.75; 15-inch, $3.25.

Beams, Scale—

Scale Beams, List Jan. 12, '82...50&10@ 50&10&5%
Chatillon's No. 1.....40%
Chatillon's No. 2.....50%
Custer's.....33⅓%

Beaters, Egg, &c—

Keystone, P.D.&C., Each, No. 1, $1; No. 2, $2.....20 %
Dover.....₱ doz $1.50
Duplex (Standard Co.).....₱ doz $1.25
Rival (Standard Co.).....₱ doz $1.00
Duplex Extra Heavy (Standard Co.)... ₱ doz $3.50
Bryant's.....₱ gro $14.00
Double (H. & R. Mfg. Co.), ₱ gro. No. 0, $12.00; No. 1, $15.00; No. 2.....$36.00
Easy (H. & R. Mfg. Co.).....₱ gro $12.00
Triple (H. & R. Mfg. Co.).....₱ gro $16.50
Spiral (H. & R. Mfg. Co.).....₱ gro $4.50
Improved Acme (H. & R. Mfg. Co.)..... ₱ gro. $9.00
Paine, Diehl & Co.'s.....₱ gro $24.00

Bells—

Cow—
Common Wrought.....60&10%
Western.....20&10%
Western, Sargent's list.....70&10%
Kentucky, "Star".....20&10%
Kentucky, Sargent's list.....70&10%
Dodge, Genuine Kentucky....70&70&10%
Texas Star.....50&10&50&10&5%
Call.....40@40&5%
Farm Bells.....₱ ₤ 3¢@3½¢
Steel Alloy Church and School Bells..40%

Door —
Gong, Abbe's .....33⅓&10%
Gong, Yankee.....45&10%
Gong, Barton's.....40&10&50%
Crank, Taylor's.....25&10%
Crank Brooks'.....50&10&2%
Crank Cone's..... 10%
Crank, Connel's .....20&10%
Lever, Sargent's.....60&10%
Lever, Taylor's Bronzed or Plated....net
Lever, Taylor's Japanned .....25&10%
Lever, R. E. M. Co.'s.....50&10&2%
Pull, Brook's..... .....50&10&2%
Pull, Western..... .....25&10%

Electric,
Wollensak's..... ....20%
Bigelow & Dowse.....20%
Taylor's 20%

Hand—
Light Brass.....75&10%
Extra Heavy.....65&10%
White Metal.....60&10&10%
Silver Chime.....33⅓&10%
Globe(Cone's Patent) .....25&10@35%

Bellows—

Blacksmiths' ....60&5@65%
Molders' .....40@40&10%
Hand Bellows.....40&10@50%

Belting, Rubber—

Common Standard .....70@70&5%
Standard..... ....60&10&10@70%
Extra.....50&10@60%
N.Y.B.&P.Co., Carbon...50&5@50&10&5%
N.Y.B.&P.Co., Diamond....40&5@40&10%

Bench Stops—See Stops, Bench.

Benders, Upsetters, Tire.

Stoddard's Lightning Tire Upsetters..15%
Detroit Perfected Tire Bender.....15%

Bits—

Auger, Gimlet, Bit Stock, Drills, &c., see Augers and Bits.

Bit Holders—See Holders.

Blind Adjusters—See Adjusters, Blind.

Blind Fasteners—See Fasteners, Blind.

Blind Staples—See Staples, Blind.

Blocks—

Ordinary Tackle, list May 20, 1889... See Trade Report.
Cleveland Block Co., Mal. Iron.... ...50%
Moore's Novelty, Mal. Iron.....50%

Boards, Stove.

Wood Lined "Crystal".....50%
"Embossed".....50%
"Oxidized".....45%
Paper Lined Zinc.....55%
"Crystal".....55%
"Embossed".....55%
"Oxidized".....45%

Bolts—

Carriage, Machine, &c.—
Com. list June 10, '84.....70&10&5&2½%
Genuine Eagle, list Oct., '84...75&10&80%
Phila. pattern, list Oct. 7, '84. .80@80&10%
R.B.&W., old list 70%
Machine, list Jan. 1, 1890..... 75&10@75&10&5%
Bolt Ends, list Jan. 1, 1890..... 75&10@75&10&5%

Door and Shutter—
Cast Iron Barrel, Square, &c..70@70&10%
Cast Iron Shutter Bolts.....70@70&10%
Cast Iron Chain (Sargent's list)....65&10%
Ives' Patent Door Bolts 60%
Wrought Barrel.....70@70&10%
Wrought Square.....70@70&10%
W'r't Shutter, all Iron, Stanley's..60&10%
W'r't Shutter, Brass Knob, " ..40&10%
W'r't Shutter, Sargent's list.....60&10%
W'r't Sunk Flush, Sargent's list....55&10%
W'r't Sunk Flush, Stanley's list....50&10%
W'r't B.K.Flush. Com'n " ....55&10%

Stove and Plow—
Stove. 60%
Plow.....60&5%
R. B. & W., Plow.....55%

Tire—
Common, list Feb. 28, '83 .....65%
Port Chester Bolt and Nut Company:
Empire. list Feb 28, '83..... ....65%
Keystone, Philadel., list Oct. '84....80%
Norway, Phila., list Oct. '84 .....75%
American Screw Company:
Norway, Phil., list Oct. 16, '84.....75%
Eagle, Phil., list Oct. 16, '84.....80%
Philadel., list Oct. 16, '84..... .....80%
Bay State, list Feb. 28, '83.....65%
R.B.&W., Philadel., list Oct. 16, '84.....80%

Borers, Tap.

Common and Rind.....20&10%
Ive's Tap Borers.....33⅓&5%
Enterprise Mfg. Co.....20&10&30%
Clark's.....33⅓@35%

Borax.—₱ ₤ 9½@10¼¢

Boring Machines—See Machines, Boring.

Bow Pins—See Pins, Bow.

Boxes, Wagon.

Per ₤.....2¾¢

Braces.—

American Bit Brace Co.:
Nos. 10, 12, 20.....60&10%
Nos. 11, 21, 24, 27.....70&10%
Nos. 22, 23, 25.....60&10&5%
Nos. 13, 26, 36, 37.....70&10&5%
Ball Braces, net .....$1.12 to $1.25¢
Amidon's
Barker's Imp'd Plain.....75&10@80%
Barker's Imp. Nickeled..65&10@70%
Ratchet.....75&10@80%
Eclipse Rachet.....60%
Globe Jawed.....40@40&10%
Corner Brace.....40@40&10%
Universal, 8 in., $2.10 10 in.....$2.25
Buffalo Ball.....$1.10@$1.15
Barber's,
Nos. 10 to 16..... 50%
Nos. 30 to 33.....50%
Nos. 40 to 63..... .....50&10%
Saxton's.
Barker's Imp. Polished.....75&10@80%
Barker's Imp. Nickeled.....65&10@70%
Ratchet, Polished..... .....50&10@60%
Ratchet, Nickeled.....40&10@50%
Buffalo Ball.....net, $1.10@$1.15
Bartholomew's,
Nos. 25, 27 and 30.....50&10@60&5%
Nos. 117, 118, 119.....70@70&5%
Common Ball, American.....$1.00@$1.10
Fray's Genuine Spofford's..50&5&50&10%
Fray's No. 70 to 120, 81 to 123, 207 to 414 50&10%
Ives' New Haven Novelty.....70@70&5%
New Haven Ratchet.....60&5@60&10%
Barber Ratchet.....60&5@60&10%
Barbers.....60&5%
Spofford.....60&5@60&10%
Osgood's Ratchet.....40&10@50%
P. S. & W. Co., Peck's Patent.....60%

Brackets—

Shelf plain, Sargent's list, 55&10@55& 10&10%
Shelf, fancy, Sargent s list, 60&10@60 &10&10%
Reading, plain.....50&10@60&10&5%
Reading, Rosette .....60&10@60&10&10%

Bright Wire Goods—See Wire.

Broilers—

Henis' Self-Basting. { Inch,..... 9 10 9x11
{ Per doz...$4.50 5.50 6.50
New Haven.....50%

Buckets, Well.

Galvanized—
Hill's.....₱ doz, 12 qt, $4.25; 14 qt, $5.2
Iron Clad.....₱ doz. 14 qt, $4.25@$4.5
Helwig's Flat Iron Band... ..$4.25@4.50
Helwig's Wired Top....₱ doz $4.00@4.25

Bull Rings—See Rings, Bull.

Butcher's Cleavers—See Cleavers Butchers'.

Butts—

Brass—
Wrought Brass.....75&10@80%
Cast Brass, Tiebout's'.....50%
Cast Brass, Corbin's, Fast.....33⅓&10%
Cast Brass, Loose Joint.....33⅓&10%

Cast Iron—
Fast Joint, Narrow.....50&10&5@60%
Fast Joint, Broad.....50&10@60%
Loose Joint.....
Loose Joint, Japanned.....
Loose Joint, Jap. with Acorns..
Parliament Butts.....
Mayer's Hinges.....
Loose Pin, Acorns.....
Loose Pin, Acorns, Japanned...
Loose Pin, Acorns, Japanned, Plated Tips..... } .70&5@ 70&10%

Wrought Steel—
Fast Joint, Narrow.....
Fast Joint, Lt. Narrow.....
Fast Joint, Broad.....
Loose Joint, Broad.....
Table Butts, Back Flaps, &c.....
Inside Blind, Regular.....
Inside Blind, Light.....
Loose Pin.....
Bronzed Wrought Butts. ....50 } 70&10%

Calipers—See Compasses.

Calks, Toe—

Gautier..... ..₱ ₤ 5½@6¢
Dewicks (Burke)..... ..₱ ₤ 5½@6¢

Can Openers—See Openers, Can.

Cards—

Horse & Curry.....10&10&10&10%
Cotton.....10&10&10%
Wool..... .....10&10&10%

Carpet Stretchers—See Stretchers Carpet.

Carpet Sweepers—See Sw Carpet.

Cartridges—See Ammunition.

Casters—

Bed.... .... } Brass....55@55&10%
Plate..... } Others...60@60&10%
Shallow Socket.... }
Deep Socket.....40&10%
Yale Casters, list May, 1884...30&10&40%
Yale, Gem. .....60@60&5%
Martin's Patent (Phœnix).....45&10&50%
Payson's Anti-friction.....60@60&10%
Giant Truck Casters.....30%
Stationary Truck Casters.....50&10%
Socket Truck Casters.....50%

Cattle Leaders—See Leaders, Cattle.

Chain—

Trace, Wagon and Fancy Chains, List revised April 21, 1890.....50& 10@60%

American Coil, in cask lots,

3-16	¼	5-16	⅜	7-16	½	⅝	¾
$7.75	5.45	4.55	4.00	3.65	3.50	3.40	3.30

Less than cask lots, add ½@¾¢ ₱ ₤.
German Coil, list of June 20, 1887 .....50&10&5@60%
German Halter Chain, list of June 20, 1887 .....50&10&5@60%
Covert Halter.....60&2%
Covert Traces.....35&2%
Covert Heel Chain .....50&2%
Oneida Halter Chain.....60@60&5%
Galvanized Pump Chain.....₱ 5½@6¢
Jack Chain, Iron.....75&10&80%
Jack Chain, Brass.....75@75&10%

Chalk—

White.....₱ gr 50¢
Red.....₱ gr 70¢
Blue.....₱ gr 85¢
See also Crayons.

Chalk Lines—See Lines.

Chisels—

Socket Framing and Firmer.
P. S. & W.....
New Haven.....
Witherby.....
Mix.....
Ohio Tool Co..... } ..75 @ 75&10
Douglass.....75@75&5%
Buck Bros.....30%
Merrill.....60&10@60&10&5%
L. & I. J. White..... .....30@30&5%

Tanged and Miscellaneous.
Tanged Firmers.....40&10@50%
Butchers'.....$4.75@$5.00
Spear & Jackson's.....$5 to $
Buck Bros.....30%
Cold Chisels, ₱ ₤ ....15@16%

Chucks—

Beach Pat.....each, $8.00.....20%
Morse's Adjustable, each, $7.00, 20@20&5%
Oanbury.....each, $6.00, 30@30&5%
Syracuse, Bals Pat.....25%
Skinner's Patent Chucks.
Combination Lathe Chucks.....33⅓%
Universal Lathe Chucks.....40%
Independent Lathe Chucks.....40%
Drill Chucks.....15%
Union Mfg. Co.,
Victor.....$8.50, 25%
Combination.....40%
Universal.....40%
Independent.....40%

Churns.

Tiffin Union No. 1, 5 gallon...$3.25 each
Tiffin Union No. 2, 7 gallon...$3.75 each
Tiffin Union No. 3, 10 gallon...$4.25 each

Clamps—

R. I. Tool Co.'s Wrought Iron.....25%
Adjustable, Cincinnati.....15&10%
Adjustable, Hammers.....15%
Adjustable, Stearn's.....30@30&10%
Stearn's Adjustable Cabinet and Corner.....30@30&10%
Cabinet, Sargent's.....60&10%
Carriage Makers', Sargent's.....70&10%
Carriage Makers', P., S. & W. Co..40&10%
Eberhard Mfg. Co.....40&5@40&10%
Warner's.....40&10@40&10&5%
Saw Clamps, see Vises. Saw Filers'.
Carpenters', Cincinnati.....25&10%

Cleavers.

Butchers'.
Bradley's.....25@30%
L. & I. J. White.....20&5%
Beatty's.....40@40&5%
New Haven Edge Tool Co.'s.....40%
P., S. & W.....33⅓&5@33⅓&10%
Foster Bros.....30%
Schulte, Lohoff & Co.....40@40&5%

Clips—

Norway, Axle, ¼ & 5-16.....55&5&5%
2nd grade Norway Axle, ¼ & 5-16. 65&5%
Superior Axle Clips.....60%&5&70%
Norway Spring Bar Clips, 5-16..60&5&5%
Wrought-Iron Felloe Clips.....₩ lb, 5½¢
Steel Felloe Clips.....₩ lb, 5¢
Baker Axle Clips.....25%

Cloth and Netting, Wire—See Wire, &c.

Cockeyes.....50%

Cocks, Brass.

Hardware list.....60&2%

Coffee Mills—See Mills, Coffee.

Collars, Dog, &c.

Medford Fancy Goods Co.....40&10%
Embossed, Gilt, Pope & Steven's list 30&10%
Leather, Pope & Steven's list.....40%
Brass, Pope & Steven's list.....40%
Chapman Mfg. Company.....50&10@60%

Combs, Curry.

Fitch's.....50&10@50&10&10%
Rubber, per doz $10.00.....20%
Perfect.....50%

Compasses, Dividers, &c.—

Compasses, Calipers, Dividers.70@70&10%
Bemis & Call Co.'s
Dividers.....60&5%
Compasses & Calipers.....50&5%
Wing and Inside or Outside.....50&5%
Double.....50%
(Call's Pat. Inside).....30%
Excelsior.....50%
J. Stevens & Co.'s.....25&10%
Starrett's
Spring Calipers and Dividers....25&10%
Lock Calipers and Dividers.....25%
Combination Dividers.....25%

Coopers' Tools—See Tools, Coopers'.

Cord, Sash—

Common.....₩ lb 10@11¢
Patent, good quality.....₩ lb 13@13½¢
White Cotton Braided, fair...₩ lb 28@29¢
Common Russia Sash.....₩ lb 13½¢
Paint " .....₩ lb 15¢
Cable Laid Italian Sash.....₩ lb 22@23¢
Indian Cable Laid " .....₩ lb 13¢
Silver Lake—
A Quality, White, 50¢.....10&10&5%
A Quality, Drab, 55¢.....10&10&5%
B Quality, White, 50¢.....28@40%
B Quality, Drab, 55¢.....31@33%
C Quality, White (only).....26½@28¢
Sylvan Spring, Extra Braided, White, 34¢
Sylvan Spring, Extra Braided, Drab..30¢
Semper Idem, Braided, White.....30¢
Egyptian, India Hemp, Braided.....25¢
Samson—
Braided, White Cotton, 50¢...30@30&5%
Braided, Drab Cotton, 55¢....30@30&5%
Braided, Italian Hemp, 55¢...30@30&5%
Braided, Linen, 80¢.....30@30&5%

Corkscrews—See Screws, Cork.

Corn Knives and Cutters—See Knives, Corn.

Crackers, Nut—

Table (H. & B. Mfg. Co.).....40%
Blake's Pattern.....₩ doz $2.00, 10%
Turner & Seymour Mfg. Co.....50%

Cradles—

Grain.....50&5&2@50&10&2%

Crayons.

White Crayons, ₩ gr, 12¢@12½¢.....10%
D. M. Stewart Mfg. Co., Metal Workers, ₩ gr, $2.50.....25%
D. M. Stewart Mfg. Co., Rolling Mill, ₩ gr, $2.50.....25%
See also Chalk.

Crow Bars—See Bars, Crow.

Curry Combs—See Combs, Curry.

Curtain Pins—See Pins Curtain.

Cutters—

Meat.
Dixon's ₩ doz.....40&5%

Nos.	1	2	3	4
	$14.00	$17.00	$19.00	$20.00

Woodruff's ₩ doz.....40&5%

Nos.		100	150
		$15.00	$18.00

Hales Pattern ₩ doz.....70@70&5%

Nos.	11	12	13
	$27.00	$33.00	$45.00

American.....30%

Nos.	1	2	3	4	B	5
Each.	$5	$7	$10	$25	$50	$60

Enterprise.....30%

Nos.	10	12	22	32	42
Each.	$3	$2.50	$4	$6	$15

Great American Meat Cutter.....30%

Nos.	112	116	118	120	122
Each.	$2.00	$2.75	$3.00	$2.50	$4.00

Miles' Challenge ₩ doz.....45@45&10%

Nos.	1	2	3
	$22.00	$30.00	$40.00

Home No. 1.....₩ doz, $26.00, 55&10%
Draw Cut, each:

Nos.	5	2	6	8
	$50	$75	$80	$225

Great American.....30%
Beef Shavers (Enterprise).....20&10@30%
Little Giant.....50%
Chadborn's Smoked Beef Cutter, ₩ doz $66.00

Tobacco.
Champion.....20&10@30%
Wood Bottom.....₩ doz $5.00@$5.25
All Iron.....₩ doz $4.25
Nashua Lock Co.'s..₩ doz, $18.00 50@55%
Wilson's.....55%
Sargents's.....₩ doz, $24, 55&10%
Acme.....₩ doz $20.00, 40%

Washer.
Smith's Pat.....₩ doz $12.00, 20&10&10%
Johnson's.....₩ doz $11.00, 33⅓%
Penny's.₩ doz Pol. $14; Jap'd, $16.00, 55%
Appleton's.....₩ doz $16.00, 60&10%
Bonney's.....30&10%
Cincinnati.....25&10%

Cutlery—

Beaver Falls & Booth's.....33⅓%
Wostenholme.....$7.75 to $

Dampers, &c—

Dampers, Buffalo.....40&10%
Buffalo Damper Clips.....40&10%
Crown Damper.....40%
Excelsior.....40&10%

Diggers, Post Hole, &c.—

Samson Post Hole Digger, ₩ doz $36.00, 25%
Fletcher Post Hole Augers, ₩ doz $36, 20%
Eureka Diggers.....₩ doz $12.50@14.00
Leed's .....₩ doz $8.00@9.00
Vaughan's Post Hole Auger, ₩ doz $13.00@14.00
Kohler's Little Giant.....₩ doz. $18.00
Kohler's Hercules.....₩ doz. 15.00
Kohler' New Champion.....₩ doz. $9.00
Schniedler.....₩ doz. $18.00
Ryan's Post Hole Diggers..₩ doz $24.00
Cronk's Post Bars, ₩ doz $60.00, 50&5&50&10%
Gibbs Post Hole Digger, ₩ doz $30.00, 50¢
Imperial, ₩ doz $15.....45%

Dividers—

See Compasses.

Dog Collars—See Collars, Dog, &c.

Door Springs—See Springs, Door.

Drawers.

Money, ₩ doz.....$18&$20

Drawing Knives—See Knives, Drawing.

Drills and Drill Stocks—

Blacksmiths'.....each $1.75
Blacksmiths' Self-Feeding, each $7.50,20%
Breast, P. S. & W.....40&10%
Breast, Wilson's.....30&5%
Breast, Millers Falls.....each $3.00, 25%
Breast, Bartholomew's....each $2.50, 25&10@40%
Ratchet, Merrill's.....20@20&5%
Ratchet, Ingersoll's.....25%
Ratchet, Parker's.....30@20&5
Ratchet, Whitney's.....20&10%
Retchet, Weston's.....20@25%
Ratchet, Moore's Triple Action...25@30%
Ratchet, Curtis & Curtis.....30%
Whitney's Hand Drill, Plain, $11.00; Adjustable, $12.00.....20&10%
Wilson's Drill Stocks.....10%
Automatic Boring Tools.....$1.75@$1.85

Twist Drills—

Morse.....50&10&5%
Standard.....50&10&5%
Syracuse (Metal list).....50&10%
Cleveland.....50&10&5%
Williams.....50&10&10%
New Process.....50&10&5%

Drill Bits.—See Augers and Bits.

Drill Chucks.—See Chucks.

Dripping Pans-See Pans, Dripping.

Drivers, Screw.

Douglas Mfg. Co.....20@20&10%
Disston's.....50%
Buck Bros.....30%
Stanley R. & L. Co.'s
Varnished Handles.....65&10%
Black Handles.....60&10%
Sargent & Co.'s
No. 1 Forged Blade.....60&10&10%
Nos. 20, 30 and 60. .....60%&10&10%
P. S. & W.....70%
Knapp & Cowles No.1.....60&10&70%
No. 1 Extra.....60@60&10
Nos. 00 & 4.....50&5@50&10&5%
Stearns'.....25&10&5%
Gay & Parsons.....35%
Champion.....25&10%
Clark's Pat.....30@33⅓%
Crawford's Adjustable.....30%
Eilrich's Socket and Ratchet..25@25&10%
Allard's Spiral, new list.....25%
Kolb's Common Sense ₩ doz $6.00, 25&10%
Syracuse Screw-Driver Bits....30&30&5%
Screw-Driver Bits.....₩ doz. 50@75¢
Screw-Driver Bits, Parr's.....₩ gro $6.25
Fray's Hol. Hdle. Sets. No. 3. $12.00, 25@25&10%
P. D. & Co.'s all Steel.....50%
Cincinnati.....25&10%
Brace Screw Drivers.....25&10%
Buck Bros.' Screw-Driver Bits.....%

Egg Beaters.—See Beaters, Egg.

Egg Poachers.—See Poachers, Egg.

Electric Bell Sets.—See Bells, Electric.

Emery.—

No. 4 to No. 54	46 gr.	150 gr.	F. FF.
Kegs, ₩ lb	4½¢	5 ¢	2½¢
½ kegs, ₩ lb	4¾¢	5½¢	2¾¢
¼ kegs, ₩ lb	5 ¢	5½¢	3 ¢
10-lb cans, 10 in case	6 ¢	6½¢	5 ¢
10-lb cans, less than 10	10 ¢	10 ¢	7½¢

Enameled and Tinned Ware—See Ware, Hollow.

Escutcheon Pins—See Pins, Escutcheon.

Escutcheons.

Door Lock....Same dis as Door Locks.
Brass Thread.....60@60&10%
Wood.....25%

Expanded Metal.

List No. 5.

Lathing.....10%
Fencing, Painted Sheets.....20%
Netting, Painted Sheets.....20%
Door Mats, Galvanized.....25%
Window Guards, Paneled.....15%
Tree Guards, Paneled.....15%

Fasteners, Blind—

Mackrell's, ₩ doz. $1.00.....20@20&10%
Van Sand's Screw Pat., $15 ₩ gr..60&10%
Van Sand's Old Pat., $15.00 ₩ gr..55&10%
Washburn's Old Pattern, ₩ gr.....$9.00
Merriman's.....new list
Austin & Eddy No. 2003 ₩ gr.....$9.00
Security Gravity, ₩ gr.....$9.00

Faucets.—

Fenn's.....40%
Bohren's Pat. Rubber Ball.....25%
Fenn's Cork Stops.....33⅓%
Star.....60%
Fray's Pat. Petroleum.....40&5&2%
B. & L. B. Co.
West's Lock, Open and Shut Key...50%
Star, Metal Plug, new list.....40%
Lockport, Metal Plug, reduced list..60%
Metallic Key, Leather Lined....60&10@60&10&10%
Cork Lined.....70&5@70&10%
Burnside's Red Cedar.....50%
Burnside's Red Cedar, bbl lots.....50&10%
John Sommers'
Peerless Best Block Tin Key.....40%
IXL, 1st quality, Cork Lined.....50%
Diamond Lock.....40%
Perfection, Fla. Red Cedar.....50%
Goodenough Cedar.....50%
Boss Metallic Key.....50%
Reliable Cork Lined.....60%
Western Pattern Cork Lined.....50%
Self-Measuring
Enterprise, ₩ doz $50.00.....20&10%
Lane's, ₩ doz $36.00.....25&10%
Victor, ₩ doz $36.00.....25&10%

Felloe Plates—See Plates, Felloe.

Fifth Wheels.—

Derby and Cincinnati.....45&5%
Brewster.....50&5%

Files—

Domestic—
Nicholson Files, Rasps, &c.....60&10@60&10&5%
Nicholson (X. F.) Files.....25%
Nicholson's Royal Files (Seconds).....75% (extra prices on certain sizes)
Other makers, best brands60&10@30&20%
Fair brands.....60&10&10@70&5%
Second quality.....70&10@75&10%
Nicholson's Horse Rasps....60&10@60&10&5%
Heller's Horse Rasps.....50&7½@50&10%
McCaffrey's Horse Rasps.....50&10%
Chelsea Horse Rasps, Hand Cut...50&10%

Imported—
Moss & Gamble....List, April 1, 1883, 15%
Butcher.....Butcher's list, 20%
Stubs.....Stubs list, 25@30%
Turton's.....Turton's list, 20@25%
Greaves' Horse Rasps..American list, 60%

Fixtures.

Grindstone—
Sargent's Patent.....70&10%
Reading Hardware Co.....30&10%
P., S. & W. Co.....50&10%

Fluting Machines—See Machines, Fluting.

Fluting Scissors—See Scissors, Fluting.

Fodder Squeezers—See Squeezers, Fodder.

Forks—

Hay, Manure, &c., Asso List.....70%
Hay, Manure, &c., Phila. List 60@60&5%
Plated, see Spoons.

Frames—

Saw—
White Vermont.....₩ gro $9.00@10.00
Red, Polished and Varnished.....₩ doz $1.50, 25%

Screen, Window and Door—
Porter's Pat. Window and Door Frame. 33⅓&10%
Warner's Screen Corner Irons..33⅓@
33⅓&10%
Stearns' Frames and Corners..25@25&10%

Freezers, Ice Cream—

White Mountain.....60@60&5%
Granite State.....65@65&5%
Arctic.....70@70&5%
American.....60%
Buffalo Champion.....65@65&5%
Shepard's Lightning.....65@65&5%
Gem.....65%
Blizzard.....70%
Double Action Crown.....60%
Crown.....60%
Star.....90%
Peerless and Giant.....60&10%
Zero and Pet.....65&10%
Boss.....65&10&10%
Keystone, P. D. & Co., each, $1.50....20%

Fruit and Jelly Presses—See Presses, Fruit and Jelly.

Fry Pans—See Pans, Fry.

Funnels.

Gerndorff's Perfection, Standard and Globe; *Tin*, 1 gro., 10 %; 2 to 5 gro., 20 %; 5 to 10 gro.....30 %
Copper, 1 to 6 doz., 15 %; 6 to 12 doz., 20 %; over 12 doz.....25 %

Fuse— ₩ 1000 ft

Common Hemp Fuse, for dry ground..$2.70
Common Cotton Fuse, for dry ground 2.35
Single Taped Fuse, for wet ground..
Double Taped Fuse, for very wet gr. 4.85
Triple Taped Fuse, for very wet gr.. 5.60
Small Gutta Percha Fuse, for water. 7.50
Large Gutta Percha Fuse, for water.12.00

Gates, Molasses—

Stebbin's Pattern.....75&10@80%
Stebbin's Genuine.....60&10&10%
Stebbin's Tinned Ends.....40&10%
Chase's Hard Metal.....50&10%
Bush's.....20%
Lincoln's Pattern.....70@70&10%
Weed's.....20&10%
Boss, ₩ doz:
No. 1, $7; No. 2, $8; No. 3, $9; No. 4, $10.....60&10&10%

Gauges.

Marking, Mortise, &c.....60&10%
Starrett's Surface, Center and Scratch. 25&10%
Wire, low list.....10&10%
Wire, Wheeler, Madden & Co.....10%
Wire, Morse's.....25%
Wire, Brown & Sharpe's.....10@20%
Wire, P. S. & W. Co.....10&10%

Gimlets—

Nail and Spike.....50&10&5%
" Eureka " Gimlets.....40&10%
" Diamond " Gimlets.....₩ gr $5.00
Double Cut, Shepardson's.....45@45&5%
Double Cut, Ives'.....60@60&5%
Double Cut, Douglass'.....40&10%
" Bee," ₩ gr $12.....25@25&5%

Glue—

Le Page's Liquid.....25@25&5%
Upton's Liquid.....35%
Le Page & Co.'s Improved Process. 25@25&5%

Glue Pots—See Pots, Glue.

Grease, Axle.

Fraser's.....Keg ₩ lb 4¢, Pail ₩ lb 5¢
Fraser's, in boxes.....₩ gr $9.50
Dixon's Everlasting, in bxs...₩ doz 1 lb $1.20; 2 lb $2.00
Dixon's Everlasting....10-lb pails, ea. 35¢
Lower grades, special brands, ₩ gr $5.50@$7.00

Grindstones—

Small, at factory.....₩ ton $7.50@9.00

Grindstone Fixtures—See Fixtures, Grindstone.

Hack Saws—See Saws.

Hafts. Awl.

Sewing, Brass Fer.₩ gr, $3.50.....45&10%
Pat. Sewing, Short.$1.00 ₩ doz.....40&10%
Pat. Sewing, Long.....₩ doz $1.20
Pat. Peg, Plain Top.₩ gr $10.00...45&10%
Pat. Peg, Leather Top.₩ gr $12.00.45&10%

Halters.

Covert's, Rope, ½-in. Jute.....50&2%
Covert's, Rope, ½-in. Hemp.....50&2%
Covert's Adj. Rope Halters.....40&2%
Covert's Hemp Horse and Cattle Tie, 50&2%
Covert's Jute Horse and Cattle Ties, 60&10&2%
Covert's Adj. Web Halters.....35&2 %

Hammers—

Handled Hammers—
Maydole's, list Dec. 1, '85.....25&10@35%
Buffalo Hammer Co.
Humason & Beckley
Atha Tool Co. } 50@50&10%
Fayette R. Plumb
C. Hammond & Son
Verree.....
Hartford, Nail Hammers...35&10@40&5%
Hartford, Machinists, &c.....50@50&10%
Magnetic Tack, Nos. 1, 2, 3, $1.35, 1.50 & 1.75.....30&10%
Nelson Tool Works.....40&10%
Warner & Nobles.....20@25
Peck, Stow & Wilcox.....40%
Sargent's.....33⅓&10%

Heavy Hammers and Sledges—
3 lb and under.....₩ lb 40¢ } 70@70&10%
3 to 5 lb.....₩ lb 36¢ }
Over 5 lb.....₩ lb 30¢ }
Wilkinson's Smiths.....10½¢@11¢₩ lb

Handcuffs and Leg Irons—See Police Goods,

Handles—

Atkins' No. 1 Loop, ₩ pair, 28¢; No. 13¢; No. 6, 16¢; No. 2 and No. Reversible, 18¢.

Cross-Cut Saw Handles—
Boynton's Loop Saw Handles, 50¢....60%
Champion.....10%

Iron, Wrought or Cast—
Door or Thumb.

Nos.	0	1	2	3
Per doz.	$0.90	1.00	1.15	1.35 1.50

60&10&1

Roggin's Latches.....₱ doz 30¢@35¢
Bronze Iron Drop Latches..₱ doz 70¢ net
Jap'd Store Door Handles—Nuts, $1.62; Plate, $1.10; no Plate, $0.88 ..... net
Barn Door, ₱ doz $1.40.....10&10%
Chest and Lifting.....70%

Wood—

Saw and Plane.....40&10@40&10&5%
Hammer, Hatchet, Axe, Sledge, &c...40%
Brad Awl.....₱ gr $2.00
Hickory Firmer Chisel, ass'd..₱ gr 4.50 } 40%
Hickory Firmer Chisel, large..₱ gr 5.00 } off
Apple Firmer Chisel, ass'd...₱ gr 5.00 } list
Apple Firmer Chisel, large...₱ gr 6.00 }
Socket Firmer Chisel, ass'd..₱ gr 3.00 }
Socket Framing Chisel, ass'd..₱ gr 5.00 }
J. S. Smith & Co.'s Pat File.....50%
File, assorted.....₱ gr 2 75 } 40@
Auger, assorted.....₱ gr 5.00 } 40&10%
Auger, large.....₱ gr 7.00 }
Pat. Auger, Ives'.....30&10%
Pat. Auger, Douglass.....₱ set $1.25
Pat. Auger, Swan's.....₱ set $1.00
Hoe, Rake, Shovel, &c.....50&10%

Hangers—

Barn Door, old patterns...60&10&10@70%
Barn Door, New England...60&10&10@70
Samson Steel Anti-Friction.....55%
Orleans Steel.....55%
Hamilton Wrought Wood Track.....55%
U. S. Wood Track.....65%
Champion.....60&10%
Rider and Wooster, Medina Mfg. Co.'s list.....70%
Climax Anti-Friction.....60%
Climax Anti-Friction for Wood Track55%
Zenith for Wood Track.....55%
Reed's Steel Arm.....50%
Challenge, Barn Door.....50%
Sterling's Imp'ved (Anti-Friction).65&10%
Victor, No. 1, $15.00; No. 2, $16.50; No. 3, $18.00.....50&2%
Cheritree.....50&10%
Kidder's.....50&10@60%
The Boss.....60&10%
Best Anti-Friction.....60&10%
Duplex (Wood Track).....60&10&5%
Terry's Pat., ₱ doz pr. 4 in, $10.00; 5 in. $12.00.....50&10%
Terry's Steel Anti-Friction Leader 50&10%
Terry's Steel Anti-Friction Ideal..50&10%
Cronk's Patent, Steel Covered.....50@5%
Wood Track Iron Clad, ₱ ft, 10¢.....50 &15@60%
Carrier Steel Anti-Friction.....50&10%
Architect, ₱ set $6.00.....20%
Eclipse.....20&10%
Felix, ₱ set $4.50.....20%
Richards'.....30@30&10%
Lane's Standard.....50&5@50&10%
Lane's New Standard.....50@50&5%
Ball Bearing Door Hanger..20&10@25&10%
Warner's Pat.....20&10@20&10&10%
Stearns' Anti-Friction.20&10@20&10&10%
Stearns' Challenge.....25&10@25&10&10%
Faultless.....40@40&5%
American, ₱ set $6.00.....20&10%
Rider & Wooster, No. 1, 62½¢; No. 2, 75¢.....40%
Paragon, Nos. 1, 2 and 3.....40&10%
Cincinnati.....25&10%
Paragon, Nos. 5, 5¼, 7 and 8.....20&10%
Crescent.....60@60&10%
Nickel Cast Iron.....50%
Nickel, Malleable Iron and Steel 40%
Scranton Anti-Friction Single Strap33⅓%
Wild West, 4 in. Wheel, $15.00; 5 in. Wheel, $21.00.....45%
Star.....40&10@40&10&5%
May.....50&5@50&10%
Barry, $6.00.....40&10%

Harness Snaps—See Snaps.

Hatchets—

American Axe and Tool Co.
Blood's.....
Hunt's.....
Hurd's.....
Mann's.....
Peck's.....
Underhill's..... } 40 & 10 @ 50&5 %
Buffalo Hammer Co.....
Fayette R. Plumb.....
C. Hammond & Son.....
Kelly's.....
Sargent & Co.....
P., S. & W. Co.....
Ten Eyck Edge Tool Co.....
Collins.....10%
Schulte, Lohoff & Co.....50@50&5%

Hay and Straw Knives—See Knives.

Hinges—

Blind Hinges—

Parker.....75&2%
Palmer.....50&5&10%
Seymour.....70&2%
Nicholson.....45&10%
Huffer.....50%
Clark's, Nos. 1, 2, 3, 5, 40 and 50 75&10&5@80%
Clark's Mortise Gravity.....50%
Sargent's, Nos. 1, 3, 5, 11, 13 75&10@55&10&5%
Sargent's, No. 12.....77&10&10%
Reading's Gravity.....75&10@75&10&5%
Shepard's
Noiseless.....75&10%
Niagara.....80%
Buffalo.....80%
Clark's Genuine Pattern.....80%
O. S., Lull & Porter.....75&10%
Acme, Lull & Porter.....75%
Queen City Reversible....70&10&5@75%
Clark's Lull & Porter, Nos. 0, 1, 1¼, 2, 2½, 3.....75&10&2½%
North's Automatic Blind Fixtures, No. 2, for Wood, $9.00; No. 3, for Brick, $11.50.....10%

Gate Hinges—

Western.....₱ doz $4.40, 60%
N. E.....₱ doz $7.00, 55%
N. E. Reversible.....₱ doz $5.20, 55&10%
Clark's, Nos. 1, 2, 3.....60&10&5%
N. Y. State.....₱ doz $5.00, 55&10%
Automatic.....₱ doz $12.50, 50%
Common Sense.....₱ doz pair $4.50, 50%
Seymour's.....45&10%
Shepard's.....60&10&5%
Reed's Latch and Hinges. ₱ doz $12.00, 50%

Spring Hinges—

Union Spring and Blank Butts.....40%
Gear's Spring Hinge Co.'s list, March 1886.....20%
Acme.....30%
J. S.....25&10%
Empire and Crown.....20%
Hero and Monarch.....55%
American, Gem, and Star.....20%
Oxford.....20%
Barker's Double Acting.....25%
Union Mfg. Co.....25%
Bommer's.....30%
Buckman's.....15@20%
Chicago.....30%
Wiles'.....10%
Devore's.....40%
Rex.....40%
Royal.....60%
Reliable.....60%
Champion.....60%
Bardsley's Patent.....40%
Stearn's.....50&10%

Wrought Iron Hinges

Strap and T.....75&10%
Screw Hook and Strap..... { 6 to 12 in., ₱ D. 4 2-10¢ / 14 to 20 in., ₱ D. 3 7-10¢ / 22 to 36 in., ₱ D. 3 2-10¢
Heavy Welded Hook..... { 6 to 12 in., ₱ D. 4 2-10¢ / 14 to 20 in., ₱ D. 3 7-10¢ / 22 to 36 in., ₱ D. 3 2-10¢
Screw Hook and Eye { ⅝ in., ₱ doz $1.50 / ¾ in., ₱ doz $2.45 / ⅞ in., ₱ doz $3.80 } 10%
Rolled Blind Hinges, Nos. 32 and 34 50&10%
Rolled Blind Hinges, Nos. 232 and 234 55&10%
Rolled Plate.....70&10%
Rolled Raised.....70&10%
Plate Hinges "Providence" { 8, 10 & 12 in., ₱ D. 5¢ / over 12 in., ₱ D. 4¢

Hoes—

Eye—

D. & H. Scovil.....20%
Lane's Crescent Planters Pattern..45&5%
Lane's Razor Blade, Scovil Pattern...30%
Maynard, S. & O. Pat.....45&5%
Sandusky Tool Co., S. & O. Pat. } 50&10&5
Am. Axe and Tool Co., S. & O. Pat. } @60%
Chattanooga Tool Co., S. & O. Pat..60& 5@60&10%
Grub.....60&10%

Handled—

Garden, Mortar, &c.....60¾&70%
Planter's, Cotton, &c.....60¾&70%
Warren Hoe.....60%
Magic.....₱ doz $4.00

Hog Rings and Ringers—See Rings and Ringers.

Hoisting Apparatus—See Machines, Hoisting.

Hollow-Ware—See Ware, Hollow.

Holders.

Bag.

Sprengle's Pat.....₱ doz $18.....60%

Bit.

Extension,
Barber's, ₱ doz $15.00.....40@40&10%
Ives, ₱ doz $20.00.....60&5@60&10%
Diagonal.....₱ doz $24.00, 40%
Angular.....₱ doz $24.00, 40&5%

File and Tool—

Bals Pat.....₱ doz $4.00; 25%
Nicholson File Holders.....20%
Dick's Tool Holder.....20%

Hooks—

Cast Iron—

Bird Cage, Sargent's list.....
Bird Cage, Reading..... } 60&10&10%
Clothes Line, Sargent's list..
Clothes Line, Reading list. 60&10@60&10&10%
Ceiling Sargent's list.....55&10&10%
Harness, Reading list..55&10@55&10&10%
Coat and Hat, Sargent's list. 55&10@60&10%
Coat and Hat, Reading.50&10@50&10&10%

Wrought Iron—

Cotton.....₱ doz $1.25
Cotton Pat. (N.Y. Mallet & Handle W'ks). 30%
Tassel and Picture (T. & S. Mfg. Co.)..50%
Wrought Staples, Hooks, &c. See Wrought Goods.

Wire—

Wire Coat and Hat, Gem, list April, 1886.....50%
Wire Coat and Hat, Miles', list April, 1886.....50%
Indestructible Coat and Hat.....45%
Wire Coat and Hat, Standard.....60%
Handy Hat and Coat.....50&10%
Steady Ceiling Hooks.....50&10%
Belt.....80@80&10%
Atlas, Coat and Hat.....60%

Miscellaneous.

Grass, No. 2, $2.00; No. 3, $2.25; No. 4, $2.50
Nolin's Grass.....₱ doz $2.25
Bush.....55@60%
Whiffletree—Patent.....55%
Hooks and Eyes—Malleable Iron. 70@70&10%
Hooks and Eyes—Brass.....60&10&10%
Fish Hooks, American.....50%
Bench Hooks.....See Bench Stops.

Horse Nails—See Nails, Horse.

Horse Shoes—See Shoes, Horse.

Hose, Rubber—

Competition.....75@75&5%
Standard.....60&10&5@60&10&10%
Extra.....50&10@60%
N. Y. B. & P. Co., Para.....25&5%
N. Y. B. & P. Co., Extra.....40@40&5%
N. Y. B. & P. Co., Dundee...50&10 @ 60%

Huskers—

Blair's Adjustable.....₱ gr $8.00
Blair's Adjustable Clipper. ..₱ gr 7.00
Hubbard's Solid Steel.....₱ gr 4.50

Indurated Fiber-Ware—See Ware, Indurated Fiber.—

Irons.

Sad—

From 4 to 10, at factory ...₱ 100 ℔, $2.30@$2.40
Self-Heating.....₱ doz $9.00 net
Self-Heating, Tailors'....₱ doz $18.00 net
Mrs. Pott's Irons.....50&5%
Enterprise Star Irons.....50&5%
Cold Handle Sad Irons.....50&5%
Ideal Irons new list.50&10@50 & 10&10%
Salamander, Irons.....25%
B. B. Sad Irons, ₱ ℔.....3 @3¼¢
Combined Fluter and Sad Iron, ₱ doz, $15.00.....15%
Fox Reversible, Self-Fluter ₱ doz $24.00
Chinese Laundry (N.E. Butt Co.) 8½¢, 15%
New England.....5¢, 15%
Mahony's Troy Pol. Irons.....25%
Sensible.....20@20&5%
National Self-Heating.....30%

Soldering—

Soldering Coppers.....₱ ℔ 22 @ 23¢
Covert's Adjustable, list Jan. 1, 1886. 35&2%

Irons, Pinking, per doz., 65¢.

Jack Screws—See Screws.

Jacks, Wagon.

Daisy.....33⅓%
Victor.....33⅓%

Kettles— Spun. Stamped.
Brass, 7 to 17 in., ₱ ℔..... 24¢ 22 ¢
Brass larger than 17 in., ₱ ℔..... 26¢ 24½¢
Enameled and Tea—See Hollow-Ware.

Keys—

Lock Asso'n list Dec. 30, 1886...50&10@ 60&5%
Eagle, Cabinet, &c.....33⅓&2%
Hotchkiss' Brass Blanks.....40%
Hotchkiss, Copper and Tinned.....40%
Hotchkiss' Pad. and Cab.....35%
Ratchet Bed Keys.....₱ doz $4.00, 15%
Wollensak Tinned.....50&10%

Knife Sharpeners—See Sharpeners, Knife.

Knives.

Butcher, Shoe, &c—

Wilson's Butcher Knives.....25@30%
Ames' Butcher Knives.....25%
Foster Bros.' Butcher, &c.....40%
Nichols' Butcher Knives.....40&10%
Ames' Shoe Knives.....20@25%
Ames' Bread Knives. ₱ doz $1.50, 15@20%
Moran's Shoe and Bread.....20%
Hay and Straw.....See Hay Knives.
Table and Pocket.....See Cutlery.
Corn, Auburn Mfg. Co. Western Pat. $2.00
Corn, Auburn Mfg. Co. Crescent.....$3.50

Corn—

Bradley's.....10%
Wadsworth's.....25%

Drawing—

Witherby, P. S. & W, Mix, New Haven..... } ..75@ 75&10 %
Merrill.....60&10@60&10&5%
Douglas.....75@75&5%
Watrous.....15&10@25%
L. & I. J. White.....20&5%
Bradley's.....35%
Adjustable Handle.....25@33⅓%
Wilkinson's Folding.....25@25&5%

Hay and Straw—

Lightning Mfrs', price ₱ doz $18.00, 25% But jobbers cut this price freely, often selling at $8 @ $8.50.
Wadsworth's.....40&7½@40&10%
Carter's Needle.....₱ doz $11.00@$11.50
Heath's.....₱ doz $13.00@13.50
Auburn Hay, Com. and Spear Point..50%
Auburn, Straw.....40%
Nolin's Hay.....₱ doz. $7.00 @ $8.00

Mincing.

Am. (2d quality), ₱ gr., 1 blade, $7; 2 blades, $12; 3 blades, $18.....net
Lothrop's.....20&10%
Smith's, ₱ doz, Single, $2.00; Double, $3 40@45%
Knapp & Cowles.....50&10@60%
Buffalo Adjustable.....₱ doz $3.00 .25%
Buffalo Double Adj'table. ₱ doz $5.00 25%

Knobs—

Door Mineral.....60@65%
Door Por. Jap'd.....70@75%
Door Por. Nickel.....$2.00@2.25
Door Por. Plated, Nickel.....$2.00@2.25
Drawer, Porcelain.....60&10@60&10&10%
Hemacite Door Knobs.....40&10@50%
Yale & Towne Wood, list Dec., 1885...40%
Furniture Plain.....75¢ gro inch, 10%
Furniture, Wood Screws.....25&10%
Base, Rubber Tip.....70&10&5%
Picture, Judd's.....60&10&10@70%
Picture, Sargent's.....70&10%
Picture, Hemacite.....35&5%
Shutter, Porcelain.....65&10%
Carriage, Jap.....₱ gro 80¢, 60&10%
Bardsley's Wood Door, Shutter, &c..40%

Ladles.—
Melting, Sargent's.....55&10%
Melting, Reading.....35&10%
Melting, Monroe's Pat...₱ doz $4.00, 40%
Melting, P. S. & W.....35&10@40%
Melting, Warner's.....30%

Lanterns—

Tubular—

Plain with Guards, ₱ doz.....$4.00@4.25
Lift Wire, with Guards.....$4.50@4.75
Square Plain, with Guards....$4.00@4.25
Sq. Lift Wire, with Guards....$4.25@4.50
Without Guards, 25¢ ₱ doz less.

Miscellaneous.

Police, Small, $6.00; Medium, $7.25; Large, $9.75.....20@25%

Lawn Mowers—See Mowers, Lawn.

Leaders, Cattle.

Humason. Beckley & Co.'s.....70%
Sargent's.....60¾&10%
Hotchkiss.....30%
Peck, Stow & W. Co.....60&10%

Lemon Squeezers—See Squeezers, Lemon.

Lifters, Transom.

Wollensak's:
Class 3 and 4, Bronzed Iron.....50%
Class 3 and 4, Bronze Metal.....25%
Class 3 and 4, Brass.....35%
Skylight Lifters.....35%
Crown, Eagle and Shield.....50%
Reiber's, list Sept. 1, 1890.
Bronzed Iron Rods.....50&10&2½%
Brass, Real Bronze or Nickel Plate .30%
Excelsior.....50&10&2%
Shaw's.....50&10%
Payson's:
Universal.....60%
Solid Grip.....60%
Imperial.....50&10%

Lines—

Cotton and Linen Fish, Draper's.....50%
Draper's Chalk.....60%
Draper's Masons' Linen, 84 ft., No. 1, $1.25; No. 2, $1.75; No. 3, $2.25; No. 4, $2.75; No. 5, $3.25.....25%
Cotton Chalk.....55%
Samson, Cotton, No. 4, $2; No. 4½, $2.50; 10%
Silver Lake, Braided, No. 0, $6.00; No. 1, $6.50; No. 2, $7.00; No. 3, $7.50 ₱ gro.....25%
Mason's Linen, No. 3½, $1.50; No. 4, $2.00; No. 4½, $2.50.
Mason's Colored Cotton.....45%
Wire Clothes.. Nos. 1P 7P 20
100 ft. $4 00 $3 50 $3.00
Ventilator Cord, Samson Braided, White or Drab Cotton..₱ doz $7.50, 20%

Locks, &c.—

Cabinet—

Eagle, Gaylord Parker and Corbin... } List March, '84, rev Jan. 1, '85..33⅓&2%
Deitz, Nos. 36 to 39.....40%
Deitz, Nos. 51 to 63.....40&10%
Deitz, Nos. 86 to 96.....30%
Stoddard Lock Co.....30&33⅓%
"Champion" Night Latches.....40%
Barnes Mfg. Co.....40@40&10%
Eagle and Corbin Trunk.....25&2%
"Champion" Cab. and Combin...33⅓%
Yale.....net prices
Romer's.....25%

Door Locks, Latches, &c.

R. & E. Mfg. Co., list Mar. 20, 1889..... } 60&10@60 &10&10
Mallory, Wheeler & Co., list July, '88..... } Much lower net prices often made.
Sargent & Co., list Aug. 1, '88
Reading Hardware Co., list Feb. 2, '88.....
Brittan, Graham & Mathes, list Jan. 1890.....60&10&10%
Perkins' Burglar Proof.....60&25%
Plate.....33⅓&2%
Barnes Mfg. Co.....40@40&10%
Yale.....net prices
Deitz Flat Key.....30%
L. & C. Round Key Latches.....30&10%
L. & C. Flat Key Latches.....33⅓&10%
Romer's Night Latches.....15%
Shepardson or U. S.....35%
Seed's N. Y. Hasp Lock.....25%

Padlocks—

List Dec. 23, '84.....75@75&10%
Brittan, Graham & Mathes.....75&10%
Yale Lock Mfg. Co.'s.....net prices
Eagle.....25&2%
Eureka, Eagle Lock Co.....40&2%
Romer's, Nos. 0 to 91.....30%
Romer's Scandinavian, &c., Nos. 100 to 505..15%
A. E. Deitz.....40%
Champon Padlocks.....40%
Hotchkiss.....30%
Star.....45%
Horseshoe.....₱ doz, $9, 40@40&10%
Barnes Mfg. Co.....40@40&10%
Nock's.....30%
Brown's Pat.....25%
Scandinavian.....90@90&10%
E. T. Fraim's Keystone Scandavian: Nos. 110, 120, 130 and 140.....90&10%
Other Nos.....65%
Ames Sword Co. up to No. 150.....40%
Ames Sword Co. above No. 150.....50%
Slaymaker Barry & Co.
No. 41 line.....45&5%
No. 31 line.....60&5%
No. 21 line.....75&5%

Sash, &c.

Clark's, No. 1, $10; No. 2, $8 ₱ gr..33⅓%
Ferguson's.....33⅓%
Morris and Triumph, list Aug. 16, 1886, 60&2%
Victor.....60&10&2%
Walker's.....10%
Attwell Mfg. Co.....25&33⅓%
Reading.....66⅔&10@66⅔&10&10%
Hammond's Window Springs.....40%
Common Sense, Jap'd, Cop'd and Br'zed.....₱ gr $4.00
Common Sense, Nickel Plated ₱ gr $10.00
Universal.....30%
Kempshall's Gravity.....60%
Kempshall's Model.....60@60&10%
Corbin's Daisy, list Feb. 15, 1886.....70%
Payson's Perfect.....60@60&10%
Hugunin's Sash Balances.....25&5&2%
Hugunin's New Sash Locks.....25&5&2%
Stoddard "Practical".....10%
Ives' Patent.....60&10@60&10&5%
Liesche's, Nos. 100 and 110, ₱ gr $8; 105, $10.00.....20&10%
Davis, Bronze, Barnes Mfg. Co.....50%
Champion Safety, list March 1, 1888 55@55&5%
Security.....70%
Buckeye.....₱ gro $4.80

Lumber Tools—See Tools, Lumber

Lustre—

Four-ounce Bottles....₱ doz, $1.75; ₱ gross.....$17.00

Machines.

Boring—

	Without Augers.	Upright.	Angular.
Douglas	$5.50	$6.75	50%
Snell's, Rice's Pat.	5.50	6.75	40&10&10
Jennings	5.50	6.75	45@45&10
Other Machines	2.35	2.75	
Phillips' Patent with Augers	7.00	7 50	

Fluting.

Knox, 4½-inch Rolls.....$3.25 each } 35%
Knox, 6-inch Rolls.....$3.60 each }
Eagle, 3½-inch Roll, $2.15.....35%
Eagle, 5½-inch Roll, $2.85.....35%
Crown, 4½ in., $3.50; 6 in., $4.00; 8 in., $6.50 each.....35%
Crown Jewel, 6 in.....$3.50 each, 35%
American, 5 in., $3.00; 6 in., $3.40; 7 in., $4.50 each.....35%
Domestic Fluter.....each, $1.50
Geneva Hand Fluter, White Metal ₱ doz $12, 25%
Crown Hand Fluter, Nos. 1, $15.00; $12.50; 3, $10.00.....30%
Shepard Hand Fluter, No. 85 ₱ doz $15 30.....40

Shepard Hand Fluter, No. 110 ₩ doz $11.00 ..... 40%
Shepard Hand Fluter, No. 95 ₩ doz $8.00 ..... 40%
Clark's Hand Fluter. ₩ doz $15.00 ..... 35%
Combined Fluter and Sad Iron, ₩ doz $15.00 ..... 30%
Buffalo ..... ₩ doz $10.00 ..... 10%

Hoisting—
Moore's Hand Hoist, with Lock Brake 20%
Moore's Differential Pulley Block 40%
Energy Mfg. Co's 25%

Mallets.

Hickory ..... 20&10@20&10&10%
Lignumvitæ ..... 20&10@20&10&10%
B. & L. Block Co., Hickory & L. V. ..... 30@30&10%

Mattocks. Regular list ..... 60&10%

Measures—
Standard Fiberware, No. 1, peck, ₩ dozen, $4; ½-peck, $3.50.

Meat Cutters—See Cutters, Meat.

Mills.

Coffee—
Box and Side, List Jan. 1, 1888 ..... 60&2%
American, Enterprise Mfg Co. ..... 20&10@30%
The Swift, Lane Bros ..... 20&10%

Mincing Knives — See Knives, Mincing.

Molasses Gates—See Gates, Molasses.

Money Drawers — See Drawers, Money.

Mowers, Lawn.

Leading makers ..... 60@60&10&5%
Other makers ..... 60&10&5@60&10&10%
Pennsylvania 60%
Continental 60%
New Model ..... 60&10&5%
New Quaker City ..... 60&10&5%
Great American ..... 60&10&5%

Muzzles—
Safety ..... ₩ doz, $3.00, 25%

Nails.

Cut and Wire. See Trade Report.
Wire Nails, Papered.
Association list, July 15, '89. .75@75&5%
Tacks Mfrs.' list ..... 60&10&10%
Wire Nails, Standard Penny.
Card June 1, '89, base ..... $2.70 @ $2.75

Horse—See Trade Report.

	Nos. 6	7	8	9	10
Ausable	.28¢	26¢	25¢	24¢	23¢.
					40&5&2%
Clinton, Fin.	.19¢	17¢	16¢	15¢	14¢ 30%
Essex	.28¢	26¢	25¢	24¢	23¢.
					25&10@25&10&10%
Lyra	.19¢	17¢	16¢	15¢,	14¢ 30%
Snowden	19¢	17¢	16¢	15¢	14¢ 30%
Putnam	.23¢	21¢	20¢	19¢	18¢.
					1000 ₺ in year 15%
Vulcan	.23¢	21¢	20¢	19¢	18¢..12½&5%
Northwest'n.	25¢	23¢	22¢	21¢	20¢.
					25@25&5%
Globe	.23¢	21¢	20¢	19¢	18¢...25&10%
Boston	.23¢	21¢	20¢	19¢	18¢.
					20&5&5&2½%
A. C.	.25¢	23¢	22¢	21¢	20¢.
					25&10@33⅓&5%
C. B.-K.	.25¢	23¢	22¢	21¢	20¢.
					25&10@33⅓&5%
Maud S.	.25¢	23¢	22¢	21¢	21¢.
					40&10&5&2%
Champlain	28¢	6¢	25¢	24¢	23¢.
					25&10&10%
New Haven	.28	26¢	25¢	24¢	23¢.
					25&10@25&10&10%
Saranac	.23¢	21¢	20¢	19¢	18¢...30&10%
Champion	.25¢	23¢	22¢	21¢	20¢.
					10&10&10%
Capewell	.28¢	26¢	5¢	24¢	23¢.
					35&5&35&10%
Star	.23¢	21¢	0¢	19¢	18¢.
					10&10&10&12½%
Anchor	.23¢	21¢	20¢	19¢	18¢ 35%
Western	.23¢	21¢	20¢	19¢	18¢...40&10%
Empire Bronzed					.14 ₩ ₺.

Picture—
Brass Head, Sargent's list ..... 50&10&10%
Brass Head, Combination list ..... 50&10%
Porcelain Head, Sargent's list. 50&10&10%
Porcelain Head, Combination list. .40&10%
Niles' Patent 40%

Nail Pullers.—See Pullers, Nail.

Nail Sets.—See Sets, Nail.

Nut Crackers.—See Crackers, Nut.

Nuts—

Nuts, off list Dec. 18, 1889:	Square.	Hex.
Hot Pressed	5.45¢	6.00¢
Cold Punched	5.00¢	4.90¢

In lots less than 100 ₺, ₩ ₺, add ½¢; 1-₺ boxes, add 1¢ to list.

Oakum—

Government ..... ₩ ₺ 7@7½¢
U. S. Navy ..... ₩ ₺ 6@6¼¢
Navy ..... ₩ ₺ 5½¢@5¾¢

Oilers—
Zinc and Tin ..... 65&10@70%
Brass and Copper ..... 50&10@50&10&5%
Malleable, Hammers' Improved, No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz. 10@10&5%
Malleable, Hammers, Old Pattern, same list 40%
Prior's Pat. or "Paragon" Zinc, 60&10&10%
Prior's Pat. or "Paragon" Brass 50%
Olmstead's Tin and Zinc 60%
Olmstead's Brass and Copper 50%
Broughton's Zinc 60%
Broughton's Brass 50%
Gem P. D. & Co. ..... ₩ gro. $2
Steel, Draper and Williams 50%

Openers, Can.
Messenger's Comet ..... ₩ doz $3.00, 25%
American ..... ₩ gross $3.00
Duplex ..... doz 25¢, 15@20%
Lyman's ..... ₩ doz $3.75, 20%
No. 4 French ..... ₩ doz $2.25, 55&60%
No. 5, Iron Handle ..... ₩ gr $6.00, 45&50%
Eureka ..... ₩ doz $2.50, 10%
Sardine Scissors ..... ₩ doz $2.75@3.00
Star ..... ₩ doz $2.7[illegible]
Sprague, No. 1, $2.00 2, $2.25; 3, $2.50 50&10&10%
Excelsior, No. 1, $2.50; No. 2, $1.50 ..40%
World's Best, ₩ gross, No. 1, $12.00; No. 2, $24.00; No. 3, $36.00 ..... 50&10%
Universal, ₩ doz $3.00 ..... [illegible]
Domestic, ₩ doz $2.50 ..... [illegible]
Champion ₩ doz $2.00 ..... [illegible]

Packing, Steam—

Rubber—
Standard ..... 60&5@65%
Extra ..... 50@50&5%
N. Y. B. & P. Co., Standard .40&10@50%
N. Y. B. & P. Co., Empire ..... 60&5@65%
N. Y. B. & P. Co., Salamander. ₩ ₺ 65¢, 10@15%
Jenkins' Standard. ₩ ₺ 80¢, ..25@25&5%

Miscellaneous—
American Packing ..... 10¢@11¢ ₩ ₺
Russia Packing ..... 14¢ ₩ ₺
Italian Packing ..... 13¢@14¢ ₩ ₺
Cotton Packing ..... 15¢@17¢ ₩ ₺
Jute ..... 7¢@8¢ ₩ ₺

Padlocks—See Locks.

Pails.

Galvanized Iron—

Quarts	10	12	14
Hill's Light Weight, ₩ doz.	$2.75	3.00	3.25
Hill's Heavy Weight, ₩ dz.	3.00	3.25	3.75
Helwig's	2.75	3.00	3.25
Sidney Shepard & Co.	2.35	2.85	3.05
Iron Clad	2.50	2.75	3.00
Fire Buckets	2.75	3.25	3.50

Buckets, see Well Buckets.
Indurated Fibre Ware—25%
Star Pails, 12 qt ..... ₩ doz $6.00
Fire, Stable and Milk, 14 qt .. ₩ doz $7.80

Standard Fibre Ware—

	Plain.	Decr'd
Water Pails, 12 qt., per doz.	$4.00	$4.50
Dairy Pails, 14 qt., per doz.	4.50	5.00
Fire Pails, No. 1, 12 qt. per doz	4.50	
Fire Pails, No. 2, 14 qt. per doz	5.00	
Sugar Pails	6.00	6.50
Horse Pails	5.00	
Buggy Pails	4.00	
Slop Jars (bal. trap)	8.00	9.00
Chamber Pails, 14 qt	6.50	7.50

Pans.—

Dripping.
Small sizes ..... ₩ ₺ 6¼¢
Large sizes ..... ₩ ₺ 5½¢

Fry—
Standard List:

No.	0	1	2	3	4
₩ doz.	$3.00	$3.75	$4.25	$4.75	$5.25
No.	5	6	7	8	
₩ doz.	$6.00	$7.00	$8.00	$9.00	

Polished, regular goods ..... 70&10%
Acme Fry Pans ..... 60&10%

Paper and Cloth—

Sand and Emery—
List April 19, 1886 ..... 50&50&10%
Sibley's Emery and Crocus Cloth 30%

Parers.

Apple.
Advance ..... ₩ doz $4.75
Baldwin ..... ₩ doz 5.25
Bonanza ..... each 5.00
Champion ..... ₩ doz 7.25
Daisy ..... ₩ doz 4.00
Dandy ..... each 7.50
Eureka, 1888 ..... each 16.00
Family Bay State ..... ₩ doz 12.00
Favorite ..... ₩ doz 5.00
Gem ..... ₩ doz 5.25
Gold Medal ..... ₩ doz 4.00
Ideal ..... ₩ doz 4.00
Improved Bay State .. ₩ doz 27.00 @ 30.00
Little Star ..... ₩ doz 4.50
Monarch ..... ₩ doz 13.50
New Lightning ..... ₩ doz 5.50
Oriole ..... ₩ doz 4.00
Penn ..... ₩ doz 4.00
Perfection ..... ₩ doz 4.00
Pomona ..... ₩ doz 4.00
Rocking Table ..... ₩ doz 6.00
Turntable ..... ₩ doz 4.50
Victor ..... ₩ doz 13.50
Waverly ..... ₩ doz 4.00
White Mountain ..... ₩ doz 4.00
72 ..... ₩ doz 4.25
76 ..... ₩ doz 5.75
78 ..... ₩ doz. 6.50

Potato—
White Mountain ..... ₩ doz $4.50
Antrim Combination ..... ₩ doz $5.50
Hoosier ..... ₩ doz $18.50
Saratoga ..... ₩ doz $5.50

Pencils—
Faber's Carpenters' ..... high list 50%
Faber's Round Gilt ..... ₩ gro $5.25
Dixon's Lead ..... ₩ gro $4.50
Dixon's Lumber ..... ₩ gro $6.75
Dixon's Carpenters' ..... 40&10%

Picks—
Railroad or Adze Eye, 5 to 6, $12.00; 6 to 7, $13.00 ..... 60&10%

Picture Nails.—See Nails, Picture.

Pinking Irons.—See Irons, Pinking.

Pins.

Box—
Humason, Beckley & Co.'s ..... 60&10%
Sargent & Co's ....$17 and $18 ..... 60&10%
Peck, Stow & W. Co. .. 50&10&50&10&5%

Curtain—
Silvered Glass ..... net
White Enamel ..... net

Escutcheon,
Iron, list Nov. 11, 1885 .. 50&10@50&10&5%
Brass ..... 60@60&5%

Pipe, Wrought Iron—
List September 18, 1889.
1¼ and under, Plain 47½%
1¼ and under, Galvanized 40%
1½ and over, Plain 60%
1½ and over, Galvanized 47½%
Boiler Tubes, Iron.
1¾ and under 45%
2 to 4 inch 50%
4-inch and larger 52½%

Planes and Plane Irons—

Wood Planes—
Molding ..... 40&2%
Bench, First Quality .. .. 55&2%
Bench, Second Quality ..... 60&2%
Bailey's (Stanley R. & L. Co.). ...40&10%

Iron Planes—
Bailey's (Stanley R. & L. Co.) ..... 40&10@40&10&10%
Miscellaneous Planes (Stanley R. & L. Co.) ..... 20&10@20&10&10%
Victor Planes (Stanley R. & L. Co.). ..... 20&10@20&10&10%
Steer's Iron Planes ..... 35@35&10%
Meriden Mal. Iron Co.'s ..... 40@40&10%
Davis's Iron Planes ..... 40@40&10%
Birmingham Plane Co. ..... 50@50&10%
Gage Tool Co.'s Self-Setting ..... 20&10&10%
Chaplin's Iron Planes ..... 40@40&10%
Sargent's ..... 30&10@30&10&10%
Standard Tool Co. ..... 50@50&5%

Plane Irons—
Butcher's ..... $5.00@$5.25 to £
Buck Bros 30%
Auburn "Thistle" ..... } 35&2%
Ohio ..... }
Sandusky ..... }
S. & I. J. White 25%

Plates.
Felloe ..... ₩ ₺ 6¢@6½¢

Pliers and Nippers—
Button's Patent ..... 50@50&10%
Hall's No. 2, 5 in., $13.50; No. 4, 7 in. $21.00 ₩ doz ..... 20&10@33⅓%
Humason & Beckley Mfg. Co. .50@50&10%
Gas Pliers 60%
Gas Pliers, Custar's Nickel Plated. .60&5%
Eureka Pliers and Nippers 40%
Russell's Parallel 25%
P. S. & W. Cast Steel 50%
P. S. & W. Tinners' Cutting Nippers, add 6% dis 10%
Carew's Pat. Wire Cutters 30%
Morrill's Parallel, ₩ doz, $12.00 .. 30&5%
Cronk's 8 in., $15.00; 10 in. $21.00, 40@40&5%

Plumbs and Levels—
Regular List ..... 70&10@70&10&10%
Disston's 50%
Pocket Levels ..... 70&10@70&10&10%
Davis Iron Levels 30%
Davis' Inclinometers ..... 10&10%

Poachers.

Egg.
Buffalo Steam Egg Poachers, ₩ doz, No. 1, $6.00; No. 2, $9.00 ..... 25%

Pokes, Animal—
Bishop's I. X. L. ..... ₩ doz $6.00
Bishop's O. K. ..... ₩ doz $5.25
Bishop's Pioneer ..... ₩ doz $3.75
Bishop's American ..... ₩ doz $2.75
Eagle, Double Stale ..... ₩ doz $5.75
Eagle, Single Stale ..... ₩ doz $3.75
Buckeye, Single Stale ..... ₩ doz $2.75

Police Goods.
R. I. Tool Co., Handcuffs, $15.00 ₩ doz 10%
R. I. Tool Co., Leg Irons, $25.00 ₩ doz 10%
Tower's 25%
Daley's Improved Handcuffs: 2 Hands, Polished, ₩ doz $48.00; Nickeled, $57.00: 3 Hands, Polished, ₩ doz $72.00; Nickeled, $84.00 ..... 25%
J. P. Lovell's Police Goods 25%

Polish, Metal.
Prestoline 30%
Prestoline Paste 33⅓%
Gaston's Silver Compound 33⅓%

Polish, Stove.
Joseph Dixon's ..... ₩ gro $6.00, 10%
Gem ..... ₩ gro $4.50, 10%
Gold Medal ..... ₩ gro $6.00, 25%
Mirror ..... ₩ pro $6.00, —%
Lustro ..... ₩ gro $4.75
Ruby ..... ₩ gro $3.75
Rising Sun, 5 gro lots ..... ₩ gro $5.50
Dixon's Plumbago ..... ₩ ₺ 8¢
Boynton's Noon Day, ₩ gro 13.00
Parlor Pride Stove Enamel .. ₩ gro
Yates' Liquid, 2 3 5 10 gal.
₩ gal ..$0.80 .70 .60 .50
Yates Standard Paste Polish, 10-₺ cans, ₩ ₺ 12½¢
Jet Black ..... ₩ gro $3.50
Japanese ..... ₩ gro $3.50
Fireside ..... ₩ gro $2.50
Diamond O. K. Enamel ..... ₩ gro $19.00
Bonnell's Liquid Stove Polish. ₩ gro $9.00
Bonnell's Paste Stove Polish. ₩ gro $6.00
Black Eagle Benzine Paste, 5 and 10 ₺ cans ..... 12½¢
Black Jack Water Paste, 5 and 10 ₺ cans ..... 12½¢
Nickel Plate Paste ..... ₩ gro $6.00

Poppers, Corn—
Round or Square, 1 qt. .₩ gr $10.00@10.50
Round or Square, 1½ qt. .₩ gr $15@15.50
Round or Square, 2 qt. .₩ gr $18.50@19.00

Post Hole and Tree Augers and Diggers—See Diggers, Post Hole, &c.

Potato Parers—See Parers, Potato.

Pots.

Glue—
Tinned 40%
Enameled ..... 40&5%
Family, Howe's "Eureka" 40%
Family, L. F. C.'s "Handy" 50%

Presses.

Fruit and Jelly—
Enterprise Mfg. Co. ..... 20&10@30%
Henis ..... ₩ doz $3.50
Shepard's Queen City 40%

Pruning Hooks and Shears.—See Shears.

Pullers.

Nail.
Curtiss Hammer ..... ₩ doz $9.00
Giant, No. 1 ..... ₩ doz. $18.00, 10%
Giant, No. 2 ..... ₩ doz, $15.00, 10%
Pelican ..... ₩ doz, $9.00, 25%

Pulleys—
Hot House, Awning, &c. ..... 60&10%
Japanned Screw ..... 60&10%
Brass Screw ..... 60&10%
Japanned Side ..... 60%&10%
Japanned Clothes Line ..... 60&10%
Empire Sash Pulley ..... 55@60%
Moore's Sash, Anti-Friction 50%
Hay Fork, Solid Eye, $4.00: Swivel, $4.50 ..... 50&10&50&10&5%
Hay Fork, "Anti-Friction," 5 in. Solid, $5.70 ..... 50%
Hay Fork, "P" Common and Pat. Bushed 20%
Hay Fork, Tarbox Pat. Iron 20%
Hay Fork, Reed's Self-Lubricating ...60%
Shade Rack 45%
Tackle Blocks ..... See Blocks
Moore's Anti-Friction 5 in. Wheel, ₩ doz $12.00 40

Pumps—
Cistern, Best Makers ..... 60@60&10%
Pitcher Spout, Best Makers ..... 67½@70%
Pitcher Spout, Cheaper Goods. 70@70&5%

Punches—
Saddlers' or Drive, good, ₩ doz ...60@65¢
Bemis & Call Co.'s Cast Steel Drive. .50&5%
Bemis & Call Co's Springfield Socket. 50&5%
Spring, good quality .... ₩ doz $2.50@2.60
Spring, Leach's Pat. 15%
Bemis & Call Co.'s Spring and Check . .40%
Solid Tinners', P. S. & W. Co., ₩ doz $1.44, 55%
Tin'rs' Hollow Punches P. S. & W. Co. 20&2%
Rice Hand Punches 15%
Avery's Revolving 40%
Avery's Saw-Set and Punch. See Saw Sets.

Rail—

Sliding Door, Wr't Brass, ₩ ₺ 35¢ 15%
Sliding Door, Bronzed Wr't Iron .. ₩ ft. 7¢
Sliding Door, Iron, Painted, ₩ foot 4¢, 40%
Barn Door Light. In. ½ ¾ ¾
Per 100 feet $2.00 2.50 3.10, 10%
B. D. for N. E. Hangers—
Small. Med. Large.
Per 100 feet ....$2.15 2.70 3.25, net
Terry's Steel Rail, ₩ foot ..... 4½¢
Victor Track Rail, 7¢ ₩ foot ..... 50&2%
Carrier Steel Rail, ₩ foot ..... 4½¢
Moore's Wrought Iron 25%

Rakes—
Cast Steel, Association goods 70%
Cast Steel, outside goods 60&10&10@70&5%
Malleable ..... 70@70&5%
Gibbs Lawn Rake ..... $12.00, 50&15
Canton Lawn Rake ..... $9.00, 50&10
Ft. Madison Prize Bow Brace and Peerless 65%
Fort Madison Steel Tooth Lawn Rake, $6.00 ..... 25%

Razors—
J. R. Torrey Razor Co 20%
Wostenholme and Butcher, $10.00 to £, 10%
Jordan's AAA1, list Nov. 1, 1889 ..... 50%
Jordan's Old Faithful, list Nov. 1, '89. 50%
Electric ..... List net

Razor Strops—See Strops, Razor.

Rings and Ringers.

Bull Rings—
Union Nut Co. 55%
Sargent's ..... 66⅔&10@70&5%
Hotchkiss' low list 30%
Humason, Beckley & Co.'s ..... 70&10%
Peck, Stow & W. Co's. .50&10&50&10&10%
Ellrich Hdw. Co., White Metal, low list; 50&50&10%

Hog—
Top of the Hill Ringers. ..... ₩ doz $2.00
Top of the Hill Rings. ..... ₩ doz $1.25
Hill's Improved Ringers . .. ₩ doz $4.25
Hill's Old Style Ringers. ..... ₩ doz $2.75
Hill's Tongs. ..... ₩ doz $4.50
Hill's Rings. ..... ₩ doz box $2.15@2.25
Perfect Rings. ..... ₩ doz box $1.60@1.70
Perfect Ringers ..... ₩ doz $2.15@2.25
Blair's Hog Ringers ..... ₩ doz $2.25@2.50
Blair's Hog Rings ..... ₩ doz 90¢@$1.00
Champion Ringers ..... ₩ doz $2.00
Champion Rings, Double ..... ₩ doz $2.00
Brown's Ringers ..... ₩ doz $2.00
Brown's Rings ..... ₩ doz $1.25@1.30

Rivets and Burrs—
Iron, list Nov. 17, '87 ..... 40%
Copper ..... 50&10%
Coppered Iron, Belatina Brand 40%

Rivet Sets—See Sets.

Rods—
Stair, Brass ..... 25&2%
Stair, Black Walnut .. .. ₩ doz 40¢

Rollers—
Barn Door, Sargent's list ..... 60&10&10%
Acme Moore's Anti-Friction 55%
Union Barn Door Roller 70%

Rope—
Manufacturers' prices:

Manila ...½ in. and larger ₩ ₺	15¢
Manila ..... ⅜ in. ₩ ₺	15½¢
Manila ..... ¼ and 5-16 in. ₩ ₺	15¾¢
Manila Tarred Rope ..... ₩ ₺	14½¢
Manila, Hay Rope ..... ₩ ₺	15¢
Sisal ...½ inch and larger ₩ ₺	10½¢
Sisal ..... ⅜ in. ₩ ₺	10¾¢
Sisal ..... ¼ and 5-16 in. ₩ ₺	11¢
Sisal, Hay Rope ..... ₩ ₺	10½¢
Sisal, Tarred Rope ..... ₩ ₺	9¾¢
Sisal, Medium Lathe Yarn ₩ ₺	9¼¢
New Zealand ..½ in. and larger ₩ ₺	9¼¢
New Zealand ..... ⅜ inch, ₩ ₺	9¾¢
New Zealand ¼ and 5-16 inch, ₩ ₺	10¢
New Zealand, Hay Rope ..... ₩ ₺	9¼¢
New Zealand, Tarred Rope .... ₩ ₺	8¾¢
Cotton Rope ..... ₩ ₺	15@18¢ net
Jute Rope ..... ₩ ₺	7½¢

1% for cash in 10 days.

Wire—
List May 1, 1886.
Iron ..... 62½&2½%
Iron, Galvanized ..... 40&2½%
Cast Steel ..... 40&2½%

Rules—
Boxwood ..... 80&10&10@80&10&10&10%
Ivory ..... 50@50&10%
Starrett's Rules and Straight Edges, Steel ..... .25&10%

Sad Irons—See Irons, Sad.

Sand and Emery Paper and Cloth—See Paper and Cloth, Sand and Emery.

Sash Cord—See Cord, Sash.

Sash Locks—See Locks, Sash.

Sash Weights—See Weights, Sash

Sausage Stuffers or Fillers—See Stuffers or Fillers, Sausage.

Saws—
Disston's Circular 45%
Disston's Cross Cuts 45%
Disston's Hand 20%
Woodrough & McPartlin.
Hand, Panel and Rip 25%
Narrow Champion Cross Cuts with Handles, ₩ foot ..... 20¢
Champion Thin Back Cross Cuts, ₩ foot ..... 28¢
Champion Extra Thin Back Cross Cuts, ₩ foot ..... 31¢
One Man Champion Cross Cuts, ₩ foot ..... 40¢
Wheeler, Madden & Clemson Mfg. Co.
Hand, Panel and Rip 30%
Narrow Champion Cross Cuts with Handles, ₩ foot ..... 20¢
Champion Thin Back Cross Cuts, ₩ foot ..... 28¢
Champion Extra Thin Back Cross Cuts, ₩ foot ..... 31¢
One Man Champion Cross Cuts, ₩ ft. 40¢

Atkins' Circular Shingle and Heading ..... dis 50%
Atkins' Silver Steel Diamond X Cuts ..... ₱ foot 70¢
Atkins' Special Steel Dexter X Cuts ..... ₱ foot 50¢
Atkins' Special Steel Diamond X Cuts ..... ₱ foot 32¢
Atkins' Champion and Electric Tooth X Cuts ..... ₱ foot 30¢
Atkins' Hollow-Back X Cuts. ..₱ foot 20¢
Atkins' Mulay, Mill and Drag 40%
Atkins' One-Man Saw, with handles. ..... ₱ foot 40¢
Peace Circular and Mill 45%
Peace Hand Panel and Rip 25%
Peace Cross Cuts 45%
Richardson's Circular and Mill 45%
Richardson's X Cuts 45%
Richardson's Hand, &c 25%

Hack Saws—

Griffin's, complete ..... 40&10@50%
Griffin's Hack Saw, Blades ..... 40&10@50%
Star Hack Saws and Blades 25%
Eureka and Crescent 35%

Scroll—

Lester, complete, $10.00 ..... 25%
Rogers, complete, $4.00 ..... 25%
Barnes' Builders' and Cabinet Makers' $15 ..... 25%
Barnes' Scroll Saw Blades 35%

Saw Frames—See Frames, Saw.

Saw Sets—See Sets, Saw.

Saw Tools—See Tools, Saw.

Scales—

Hatch, Counter, No. 171, good quality, ₱ doz $21.00
Hatch, Tea, No. 161 ..₱ doz $6.75@$7.00
Union Platform, Plain ..... $2.10@2.20
Union Platform, Striped ..... $2.20@2.30
Chatillon's Grocers' Trip Scales 50%
Chatillon's Eureka. 25%
Chatillon's Favorite 40%
Family, Turnbulls ..... 30@30&10%
Riehle bros.' Platform 40%

Scale Beams—See Beams, Scale

Scissors, Fluting 45%

Scrapers—

Adjustable Box Scraper (S. R. & L. Co.) $6.50 ..... 30&10%
Box, 1 Handle ..... ₱ doz $4.00, 10%
Box, 2 Handle ..₱ doz $6.00, 10%
Defiance Box and Ship ..... 20&10%
Foot ..... 50&10@60%
Ship, Common .... ₱ doz $3.50 net
Ship, R. I. Tool Co 10%

Screen Window and Door Frames—See Frames.

Screw Drivers—See Drivers, Screw.

Screws.

Bench and Hand—

Bench, Iron ..... 55&10@55&10&10%
Bench, Wood, Beech ..... ₱ doz $2.25
Bench, Wood, Hickory ..... 20&10%
Hand, Wood ..... 25&10@25&10&5%
Lag, Blunt Point, list Jan. 1, 1890. 75&10%
Coach and Lag, Gimlet Point, list Jan. 1, 1890 ..... 75@75&10%
Bed ..... 25&5%
Hand Rail, Sargent's ..... 60%&10%
Hand Rail, H. & B. Mfg. Co ..70&10@75%
Hand Rail, Am. Screw Co 75%
Jack Screws, Millers Falls list. .50@50&5%
Jack Screws, P. S. & W 35%
Jack Screws, Sargent ..60&10@60&10&5%
Jack Screws Stearns' ..... 40@40&10%

Cork—

Humason & Beckley Mfg. Co..40&10@50%
Williamson's ..... 33⅓@33⅓&5%
Howe Bros & Hulbert 35%

Machine—

Flat Head, Iron 55%
Round Head, Iron 50%

Wood—

List March 1, 1889.

Flat Head Iron 50%		
Round Head Iron 40%		
Flat Head Brass 45%		Extra
Round Head Brass 35%		10 @ 10&5 %
Flat Head Bronze 45%		often given
Round Head Bronze ..35%		

Rogers' Drive Screws 66⅔%

Scroll Saws—See Saws, Scroll.

Scythe Snaths—See Snaths, Scythe.

Sets.

Awl and Tool.

Aiken's Sets, Awls and Tools, No. 20, ₱ doz $10.00 ..... 55&10%
Fray's Adj. Tool Hdls., Nos. 1, $12; 2, $18; 3, $12; 4, $9. ..... 25@25&10%
Miller's Falls Adj. Tool Hdls., Nos. 1, $12. 2, $18 ..... 25%
Henry's Combination Haft ..₱ doz $6.50
Brad Sets, No. 42, $10.50; No. 43, $12.50. .70&10&5%
Stanley's Excelsior: No. 1, $7.50; No. 2, $4.00; No. 3, $5.50 ..... 30&10%

Nail—

Square ..... ₱ gr., $4.00@$4.25
Round ..... ₱ gr. $3.25
Buck Bros 27½%
Cannon's Diamond Point ..₱ gr., $12, 20%

Rivet.

Regular list ..... 50&10%

Saw—

Stillman's Genuine ..₱ doz $5.00@7.75, 40&5%
Stillman's Imita ..... ₱ doz $3.25@5.25, 40&5@40&10%
Common Lever ..... ₱ doz $2.00, 40&5%
Morrill's No. 1, $15.00; Nos. 3&4, $24.00, 40&10@50%
Leach's ..No. 0, $8.00; No. 1, $15, 15@20%
Nash's ..... 20%10@20&10&10%
Hammer, Hotchkiss $5.50, 10%
Hammer, Bemis & Call Co.'s new Pat. ..... 30&5%
Bemis & Call Co.'s Lever and Spring Hammer ..... 30&5%
Bemis & Call Co.'s Plate 10%
Bemis & Call Co.'s Cross Cut 12½%
Aiken's Genuine ..... $13.00, 50&10%
Aiken's Imitation ..... $7.00, 55&5%
Hart's Pat. Lever 20%
Disston's Star. 25%
Leopold ..... 40&10@50%
Atkin's Lever ..... ₱ doz No. 1, $6.00
Atkin's Criterion ..... ₱ doz No. 1, $6.00
Croissant (Keller), No. 1, $15.00; No. 2, $24.00 ..... 40&10%
Avery's Saw Set and Punch 50%
Chieftain H. R. Co.'s Superior ..... ₱ doz $15, 50%

Sharpeners, Knife.

Parkin s.
Applewood Handles ..₱ doz $6.00, 40%
Rosewood or Cocobolo. ₱ doz $9.00, 40%

Shaves, Spoke.

Iron 45%
Wood 30%
Bailey's (Stanley R. & L. Co.) ..... 40&10%
Stearns' ..... 30&10%
Cincinnati ..... 25&10%

Shears—

American (Cast) Iron ..75&10@75&10&5%
Barnard's Lamp Trimmers ..₱ doz $3.75
Tinners' ..... 20&2%
Seymour's, List, Dec., 1881. 60&10&10@60&10&10&5%
Heinisch's, List, Dec., 1881. 60&10&10@60&10&10&5%
Heinisch's Tailor's Shears 33⅓%
First quality C. S. Trimmers. .80@80&10%
Second quality C. S. Trimmers. 80&10@80&10&10%
Acme Cast Shears ..... 10&10%
Diamond Cast Shears 10%
Clipper ..... 10&10%
Victor Cast Shears ..... 75&10@75&10&5%
Howe Bros. & Hulbert, Solid Forged Steel 40%
Chicago Drop Forge & F. Co., Solid Steel Forged 60%
Clauss Shear Co., Japanned 70%
Clauss Shear Co., Nickeled, same list. 60%
Electric ..... List net

Pruning Shears and Hooks.

Disston's Combined Pruning Hook and Saw ..... ₱ doz $18.00, 20&10%
Disston's Pruning Hook, ₱ doz $12.00, 20&10%
E. S. Lee & Co.'s Pruning Tools 40%
Pruning Shears, Henry's Pat, ₱ doz $3.75@4.00 net
Henry's Pruning Shears, ₱ doz $4.25@ 4.50 net
Wheeler, M. & C. Co.'s Combination, ₱ doz $12.00, 20%
Dunlap's Saw and Chisel, ₱ doz $8.50, 30%
J. Mallinson & Co., No. 1, $5.25; No. 2 7.25
P., S. & W. Co 60%

Tinners', &c.—

Shears and Snips (P. S. & W.) ..... 20@25%
Snips, J. Mallinson & Co 33⅓%

Sheaves—

Sliding Door—

M. W. Co., list July, 1888 ..50&10@60&5%
R. & E., list Dec. 18, 1885 ..... 55&20%
Corbin's list ..... 60&10&2%
Patent Roller ..... 60&10&2%
Patent Roller, Hatfield's 75%
Russell's Anti-Friction, list Dec. 18, 1885 ..... 60&2%
Moore's Anti-Friction 50%

Sliding Shutter—

R. & E. list Dec. 18, 1885 ..... 60&10&2%
Sargent's list ..... 60&10%
Reading list ..... 60&10&10%

Ship Tools—

L. & I. J. White ..... 20&5%

Shoes, Horse, Mule, &c.—

Horse—

Burden's, Perkins', Phœnix, at factory. $4.00

Mule—

Add $1 ₱ keg to above prices.

Ox, Wrought—

Ton lots ..... ₱ ℔ 9¢
1000 ℔ lots ..... ₱ ℔ 9½¢
500 ℔ lots ..... ₱ ℔ 10¢

Shot—

(Eastern prices 2¢ off, cash, 5 days.

Drop, ₱ bag, 25 ℔ $1.62
Drop, ₱ bag, 5 ℔ ..... .38
Buck and Chilled, ₱ 25-℔ bag 1.87
Buck and Chilled, ₱ 5-℔ bag ..... .43

Shovels and Spades—

Ames' Shovels, Spades, &c., list Nov. 1, 1885 ..... 20%
NOTE.—Jobbers frequently give 5&7½% extra on above.
Griffith's Black Iron ..... 50&10%
Griffith's C. S. ..... 60@60&10%
Griffith's Solid C. S. R. R. Goods 20%
Old Colony (Sanford Fork & Tool Co). 35%
St. Louis Shovel Co ..... 20@20&7½%
Hussey, Binns & Co ..... .15@25%
Hubbard & Co ..... 20@20&7½%
Lehigh Mfg. Co ..... 50&10%
Payne Pettebone & Son, list January, 1886 ..... 30%
Remington's Lowtman's Pat. ..₱ doz 40%
Rowland's, Black Iron ..... 50&10%
Rowland's Steel ..... 60&5@60&10%

Shovels and Tongs—

Iron Head ..... 60&10@60&10&5%
Brass Head ..... 60&10&10%

Sieves—

Mann's Tin Rim ..... 50&25%
Buffalo Metallic, S. S. & Co ..... 50&25%
Shaker (Barler's Pat.) Flour Sifters ..... ₱ doz $2.00; ₱ gr $21.60
Electric ..... ₱ gr $21.00
A. & W. Sifters ..... ₱ doz $3.00
Hunter's ..... ₱ doz $2.00
Smith's Adjustable Sifters ..₱ doz $2.00
Smith's Adjustable Milk Strainer. ..... ₱ doz $2.00
Smith's Adjustable T. & C. Strainer. ..... ₱ doz. $1.25

Sieves, Wooden Rim—

	Iron.	Plated.
Mesh 18, Nested, ₱ doz..	80¢	$1.00
Mesh 20, Nested, ₱ doz..	95¢	1.10
Mesh 24, Nested, ₱ doz..	$1.15	1.25

Skeins, Thimble—

Western list ..... 75&5@75&10%
Columbus Wrt. Steel. Special net prices
Coldbrookdale Iron Co 60%
Utica P. S. T. Skeins 60%
Utica Turned and Fitted 35%

Slates—

School, by case ..... .50@50&10%

Snaps, Harness, &c.—

Anchor (T. & S. Mfg. Co.) 65%
Fitch's (Bristol) ..... .50&10%
Hotchkiss 10%
Andrews 50%
Sargent's Patent Guarded ..... 70&10&10%
German, new list ..... 40&10%
Covert ..... 50&2%
Covert, New Patent ..... 50&5&2%
Covert, New R. E. ..... 60&2%
Covered Spring ..... 60&10&10%

Snaths, Scythe.

List ..... 50&10@50&10&5%

Soldering Irons—See Irons, Soldering.

Spittoons, Cuspidors, &c.

Standard Fiberware—

Cuspidors, 8¼-inch, ₱ doz., No. 5, $8; No. 5X $9.
Spittoons, Daisy, 8-inch, No. 1, $4; 10 and 11 inch, $6.

Spoke Shaves—See Shaves, Spoke.

Spoke Trimmers—See Trimmers, Spoke.

Spoons and Forks—

Tinned Iron—

Basting, Cen. Stamp. Co.'s list ..... 70&10%
Solid Table and Tea, Cen. Stamp. Co.'s list ..... 70&10%
Buffalo S. S. & Co ..... 33⅓&2%

Silver-Plated—(4 mos. or 5% cash 30 days).

Meriden Brit. Co., Rogers ..... 40&15%
C. Rogers & Bros ..... 40&15%
Rogers & Bro ..... 40&15%
Reed & Barton ..... 40@40&5%
Wm. Rogers Mfg. Co ..... 40, 15&5%
Simpson, Hall, Miller & Co ..... 40, 15&5%
Holmes & Edwards Silver Co ..40, 15&5%
L. Boardman & Son 60%

Miscellaneous.

Holmes & Edwards Silver Co.:
No. 67 Mexican Silver ..... 50&10&5%
No. 30 Silver Metal ..... 50&10&5%
No. 24 German Silver ..... 50&10&5%
No. 50 Nickel Silver ..... 50&5%
No. 49 Nickel Silver ..... 50&10&5%
Wm. Rogers Mfg. Co.
Rogers' Silver Metal ..... 50, 10&6%
18% Rogers' German Silver ..... 60&6%
22% Rogers' Nickel Silver ..... 50&6%
German Silver ..... 50&50&5
German Silver, Hall & Elton. .50&5% cash
Nickel Silver ..... 50&5@50&10&5% cash
Britannia 60%
Boardman's Nickel Silver ..... 50&5% cash
Boardman's Britannia Spoons, case lots ..... 60&5% cash

Springs, Door.

Torrey's Rod, regular size ..₱ doz $1.30
Gray's, ₱ gr., $20.00 ..... 20%
Bee Rod ₱ gr., $20.00 ..... 20%
Warner's No. 1, ₱ doz, $2.50; No. 2, $3.30 ..... 40&10@50%
Gem (Coil), list April 19, 1886 ..... 10%
Star (Coil), list April 19, 1886 ..... 20%
Victor (Coil) ..... 60@60&10%
Champion (Coil) ..... 60&10@60&10&10%
Philadelphia, 5 in., $5.00; 8 in., $7.75.. %
Cowell's ..No. 1, ₱ doz, $18.00; No. 2, $15.00 ..... 50%
Rubber, complete, ₱ doz, $4.50 ..55&10%
Hercules 50%
Shaw Door Check and Spring. 25@30@35%
Elliptic, Concord, Platform and Half Scroll ..... 60@60&5%
Cliff's Bolster Springs 25%

Squares—

Steel and Iron, Nickel-Plated .....80 &10%
Try Square and T Bevels ..60&10@60&10&10%
Disston's Try Square and T Bevels 50%
Winterbottom's Try and Miter ..... 30&10%
Starrett's Micrometer Caliper Squares. 25%
Avery's Flush Bevel Squares 40%
Avery's Bevel Protractor 50%

Squeezers.

Fodder.—

Blair's ..... ₱ doz $2.00
Blair's "Climax" ..... ₱ doz $1.25

Lemon—

Porcelain Lined, No. 1 ..₱ doz $6.00, 25&30%
Wood, No. 2 ..... ₱ doz $3.00, 35%
Wood, Common ..... ₱ doz $1.70@1.75
Dunlap's Improved ..₱ doz $3.75, 20%
Sammis ..No. 1, $5.00; No. 2, $9; 12, $18 ₱ doz ..... 25&10%
Jennings' Star ..... ₱ doz $2.50
The Boss ..... ₱ doz $2.50
Dean's ..Nos. 1, ₱ doz $6.50; 2, $3.35; 3, $1.90; Queen, $2.50
Little Giant ..... 50@50&5%
King ..... 40&5%
Hotchkiss Straight Flash ..₱ doz $12.00

Standard Fiber Ware—See Ware, Standard Fiber.

Staples.

Blind—

Barbed, ½ in. and larger. ..₱ ℔ 7@7½¢
Barbed, ¾ in ....₱ ℔ 8@8½¢
Fence Staples, Galvanized. } Same price
Fence Staples, Plain ..... } as B'b'd Wire. See Trd. Rep.

Steelyards ..... 40&10@50%

Stocks and Dies—

Blacksmith's
Waterford Goods ..... 40@40&10%
Butterfield's Goods ..... 40@40&10%
Lightning Screw Plate ..... 25@30%
Reece's New Screw Plates ..33⅓&5@40%
Reversible Ratchet 30%
Gardner 25%

Stops, Bench.

Morrill's ..... ₱ doz $9, 50%
Hotchkiss's ..... ₱ doz $5 10@10&10%
Weston's, No. 1, $10; No. 2, $9.25&10&5%
McGill's ..... ₱ doz $3 ..... 10%
Cincinnati ..... 25&10%

Stone—

Hindostan No. 1, 3¢; Axe, 3½¢; Slips No. 1, 4½¢
Sand Stone ..... ₱ ℔ 2½¢
Washita Stone, Extra ..... ₱ ℔ 20@21¢
Washita Stone, No. 1 ..... ₱ ℔ 15@16¢
Washita Stone, No. 2 ..... ₱ ℔ 11@12¢
Washita Slips, No. 1, Extra ..₱ ℔ 37@40¢
Washita Slips, No. 1 ..... ₱ ℔ 25@26¢
Arkansas Stone, No. 1, 4 to 6 in ₱ ℔ $1.50
Arkansas Stone, No. 1, 6 to 9 in ₱ ℔ $1.85
Turkey Oil Stone, 4 to 8 in ..... ₱ ℔ 40¢
Turkey Slips ..... ₱ ℔ $1.00@1.50
Lake Superior, Chase ..... ₱ ℔ 16¢
Lake Superior Slips, Chase ..₱ ℔ 31@32¢
Seneca Stone, Red Paper Brand ..... ₱ ℔ 18@20¢
Seneca Stone, High Rounds ..₱ ℔ 20@25¢
Seneca Stone, Small Whets ..₱ gro $24.00

Stove Polish—See Polish, Stove.

Stretchers, Carpet.

Cast Steel, Polished ..... ₱ doz $2.25
Cast Iron, Steel Points ..... ₱ doz 80¢
Socket ..... ₱ doz $1.75
Bullard's ..... 25@25&10%

Strops, Razor—

Genuine Emerson ..... 60@60&5%
Imitation " ..... ₱ doz $2.00, 20&10&5%
Torrey's 20%
Badger's Belt and Com ..... ₱ doz $2.00
Lamont Combination ..... ₱ doz $4.00
Jordan's Pat Padded, list Nov. 1, '89. 50%
Electric ..... List net

Stuffers or Fillers, Sausage—

Miles' "Challenge," ₱ doz $20, 50@50&5%
Perry ..... ₱ doz, No. 1, $15.00; No. 0, $21.00 ..... 50&5@50&10%
Draw Cut No. 4, each $30.00 ..... 20%
Enterprise Mfg. Co ..... 20&10@30%
Silver's ..... 40&10%

Sweepers, Carpet.

Bissell No. 5 ..... ₱ doz $17.00
Bissell No. 7 New Drop Pan. ₱ doz $19.00
Bissell, Grand ..... ₱ doz $30.00
Grand Rapids ..... ₱ doz $24.00
Crown Jewel, No. 1, $18.00; No. 2, $19.00; No. 3, $20.00
Magic ..... ₱ doz $15.00
Jewel ..... ₱ doz $17.00
Improved Parlor Queen, Nickeled ..... ₱ doz $27.00
Japanned ..... ₱ doz $24.00
Excelsior ..... ₱ doz $22.00
Garland ..... ₱ doz $18.00
Parlor Queen ..... ₱ doz $24.00
Housewife's Delight ..... ₱ doz $15.00
Queen ..... ₱ doz $16.00
Queen, with band ..... ₱ doz $18.00
King ..... ₱ doz $30.00
Weed, Improved ..... ₱ doz $18.00
Hub ..... ₱ doz $16.00
Cog-Wheel ..... ₱ doz $16.00
Conqueror ..... ₱ doz $22.00
Easy ..... ₱ doz $22.00
Monarch ..... ₱ doz $22.00
Goshen ..... ₱ doz $21.00

Tacks, Brads, &c.—

List Oct. 19, 1889. Standard Weights.

Carpet Tacks—
American Iron, Blued 77½%
Am'ican Iron, Tin'd or Cop'd. 77½%
Steel, Plain or Bright 75%
Steel, Tinned or Coppered 75%
Swedes Iron, Blued 75%
Swedes Iron, Tinned or Cop'd 75%
American Iron Cut Tacks 75%
Swedes Ir. Uphol'rs' Tacks, Blued. 75%
Swedes Iron Upholsterers' Tacks, Tinned 77½%
Gimp and Lace Tacks, Blued 70%
Gimp and Lace Tacks, Tinned. 77½%
Swedes Iron Basket or Trimmers' Tacks ..... 70&10%
Miners' Tacks 77½%
Bill-Posters' or Railroad Tacks. 75%
Bill-Posters' or Railroad Tacks, Tinned 77½%
Copper Tacks 40%
Copper Finish. & Trunk Nails 40%
Cigar Box Nails 50%
Zinc Glaziers' Points 50%
Picture-Frame Points 50%
Looking-Glass Tacks 50%
Brush Tacks 60%
Tin-Capped Trunk Nails 60%
Finishing Nails 70%
Trunk and Clout Nails, Black and Tinned 72½%
Common and Patent Brads 70%
Hungarian Nails 70%
Basket and Chair Nails 65%
Leathered Carpet Tacks 40%

Miscellaneous—

Double-Pointed 82½%
Wire Carpet Nails ..... 60&10%
Plymouth Rock Steel Carpet Tacks..25%

Extra 10 @ 10&10 %

Wire Brads & Nails, see Nails, Wire.
Steel-Wire Brads, R. & E. Mfg. Co.'s list.....50&10%

Tapes, Measuring—

American.....40@40&5%
Spring.....40%
Chesterman's, Regular list.....25@30%

Thermometers—

Tin Case.....80@80&10%

Thimble Skeins—See Skeins.

Ties, Bale—Steel

Standard Wire, list.....50&10&5%

Tinners' Shears, &c.—See Shears, Tinners', &c.

Tinware—

Stamped, Japanned and Pieced, list Jan. 20 1887.....70&10@70&10&5%

Tire Benders, Upsetters, &c—
See Benders and Upsetters, Tire.

Tools.

Coopers'—

Bradley's.....20%
Barton's.....20@20&5%
L. & I. J. White.....20&5%
Albertson Mfg. Co.....25%
Beatty's.....30%
Sandusky Tool Co.....30@30&5%
Shaves, Cincinnati Tool Co.....20%

Lumber.

Ring Peavies, "Blue Line"...₱ doz $20.00
Ring Peavies, Common.....₱ doz $18.00
Steel Socket Peavies.....₱ doz $21.00
Mall. Iron Socket Peavies....₱ doz $19.00
Cant Hooks, "Blue Line"...₱ doz $16.00
Cant Hooks, Common Finish..₱ doz $14.00
Cant Hooks, Mall. Socket Clasp, "Blue Line" Finish.....$16.00
Cant Hooks, Mall. Socket Clasp, Common Finish.....₱ doz $14.50
Cant Hooks, Clip Clasp, "Blue Line" Finish.....₱ doz $14.00
Cant Hooks, Clip Clasp, Common Finish.....₱ doz $12.00
Hand Spikes....₱ doz 6 ft., $15.00; 8 ft., $20.00

Pike Poles, Pike & Hook, ₱ doz., 12 ft., $11.50; 14 ft., $12.50; 16 ft., $14.50; 18 ft., $17.50; 20 ft., $21.50.
Pike Poles, Pike only, ₱ doz, 12 ft., $10.00; 14 ft., $11.00; 16 ft., $13.00; 18 ft., $16.00; 20 ft., $20.00.
Pike Poles, not ironed, ₱ doz, 12 ft. $6.00; 14 ft., $7.00; 16 ft., $9.00; 18 ft., $12.00; 20 ft., $16.00.
Setting Poles, ₱ doz, 12 ft., $14.00; 14 ft., $15.00; 16 ft., $17.00
Swamp Hooks.....₱ doz $18.00

Saw.

Atkins' Perfection.....₱ doz $12.00
Atkins' Excelsior.....₱ doz $6.00
Atkins' Giant.....₱ doz $4.00

Tobacco Cutters—See Cutters, Tobacco.

Transom Lifters—See Lifters, Transom.

Traps—

Game—

Newhouse.....40@40&5%
Oneida Pattern.....70&10%
Game, Blake's Patent.....40&10&5%

Mouse and Rat—

Mouse Wood, Choker, ₱ doz holes, 11@12¢
Mouse, Round Wire.....₱ doz $1.50, 10%
Mouse, Cage, Wire.....₱ doz $2.50, 10%
Mouse, Catch-'em-alive....₱ dz $2.50 15%
Mouse, Bonanza.....₱ gr
Mouse, Delusion.....₱ gr
Rat, Decoy.....₱ gr $10.00, 10%
Ideal.....₱ gr $10.00
Cyclone.....₱ gr $5.25
Hotchkiss Metallic Mouse, 5-hole traps, ₱ doz., 90¢; in full cases, ₱ doz.....75¢
Hotchkiss Imp. Rat Killer..₱ gro $18.50
Hotchkiss New Rat Killer...₱ gro $16.50
Schuyler's Rat Killer.....₱ gro $15.00

Triers—

Butter and cheese.....25%

Trimmers, Spoke.

Bonney's.....₱ doz $10.00, 50%
Stearns'.....20&10%
Ives', No. 1, $15.00; No. 2, $12.00 ₱ doz. 55&10%
Douglas'.....₱ doz $9.00, 20%
Cincinnati.....25%

Trowels—

Lothrop's Brick and Plastering, 20&10&5@35%
Reed's Brick and Plastering.....15%
Disston's Br'k and Plastering.....25%
Peace's Plastering.....25%
Clement & Maynard's.....20%
Rose's Brick.....15@20%
Brade's Brick.....25%
Worrall's Brick and Plastering.....20%
Garden.....70%

Trucks, Warehouse, &c.—

B. & L. Block Co.'s list, '82.....40%

Tubes, Boiler—
See Pipe.

Twine—

Flax Twine—	BC.	B.
No. 9, ¼ and ½ ℔ Balls	26¢	34¢
No. 12, ¼ and ½ ℔ Balls	25¢	33¢
No. 18, ¼ and ½ ℔ Balls	22¢	32¢
No. 24, ¼ and ½ ℔ Balls	22¢	32¢
No. 36, ¼ and ½ ℔ Balls	20¢	31¢

No. 264, Mattrass, ¼ and ½ ℔ Balls.52@54¢
Chalk Line, Cotton, ½ ℔ Balls.....25¢
Mason Line, Linen, ½ ℔ Balls.....55¢
2-Ply Hemp, ¼ and ½ ℔ Balls (Spring Twine).....15½¢
3-Ply Hemp, 1 ℔ Balls.....16¢@16½¢
3-Ply Hemp, 1½ ℔ Balls.....15¢@15½¢
Cotton Wrapping, 5 Balls to ℔..15¢@16¢
2, 3, 4 and 5-Ply Jute, ½ ℔ Balls.....10¢
Wool.....6½¢@6¾¢
Paper.....13¢@14¢
Cotton Mops, 6, 9, 12 and 15 ℔ to doz..18¢

Vises—

Solid Box.....50&10@50&10&5%

Parallel—

Fisher & Norris Double Screw.....15&10%
Stephens'.....25@30%
Parker's.....20@25%
Wilson's.....55%
Howard's.....40%
Bonney's.....40&10%
Millers Falls.....40@40&10%
Trenton.....40&5@40&10%
Merrill's.....15@20%
Sargent's.....60&10&10%
Backus and Union.....40%
Double Screw Leg.....15&10%
Prentiss.....20@25%
Simpson's Adjustable.....40%
Moore's.....20%

Saw Filers—

Bonney's, Nos. 2 & 3, $15.00.....40&10%
Stearn's.....33⅓&10@33⅓&10&10%
Stearn's Silent Saw Vises.....33⅓@35%
Sargent's.....66⅔&10%
Hopkins'.....₱ doz $17.50, 10%
Reading.....40&10%
Wentworth.....20&10%
Combination Hand Vises.....₱ gr $42.00
Cowell Hand Vises.....20%
Bauer's Pipe Vises.....10%
Cincinnati.....25&10%

Wagon Boxes—See Boxes, Wagon.

Washer Cutters—See Cutters Washer.

Wagon Jacks—See Jacks, Wagon.

Ware, Hollow, Enameled, &c.

Cast Iron, Hollow—

Stove Hollow-Ware—
Ground.....55&5@60&5%
Unground.....65&10@65&10&5%
White Enameled-Ware—
Maslin Kettles.....60&10&5%
Boilers and Saucepans.....40%
Tinned Boilers and Saucepans.....40%
Rustless Hollow-Ware.....50@50&5%
Gray Enameled-Ware—
Stove.....50%
Maslin Kettles.....60&10&10%
Boilers and Saucepans.....40&5%

Enameled—

Agate and Granite Ware, list Jan. 1, 1889.....33⅓&10%
Ironclad Enameled Ware...dis 33⅓&10%

Kettles—

Galvanized Tea-Kettles—

Inch....	6	7	8	9
Each....	55¢	60¢	65¢	75¢

Standard Fiber—

	Per Dozen. Plain.	Dec'r'd
Wash-Basins, 10½ in.	$2.00	$2.25
Wash-Basins, 12 in.	2.25	2.75
Keelers, 11¼ in.		4.00
Cuspidors		8.00
Spittoons, "Daisy," 8 in....	4.00	4.50
Peck Measure	4.00	
Half-peck Measure	3.50	

See also Pails.

Indurated Fiber—25%

Spittoons, No. 2, ₱ doz.....$9.00
Basins, Ringed, ₱ doz., No. 2, $4.80; No. 3.....$4.20
Washtubs, Nested, Nos. 0, 1, 2 and 3 (4 pieces), ₱ nest.....$7.50
Keelers, Nested, Nos. 1, 2, 3 and 4 (4 pieces), ₱ nest.....$3.70
Butter Bowls 15, 17 and 19-inch (3 pieces), ₱ nest.....$2.25
Liquid Measures, pt., qt., 2 qt. and funnell (4 pieces) ₱ set.....$3.00
Dry Measures, 1, 2, 4, 8 and 16 qts. (5 pieces), ₱ set.....$3 00
See also *Pails.*

Silver Plated, Hollow—
4 mo. or 5 % cash in 30 days.

Reed & Barton, Meriden Britannia Co., Simpson, Hall, Miller & Co., Rogers & Brother.....40&5%
Hartford Silver Plate Co, William Rogers Mfg. Co.....40&5&5%

Washers—

Size.	¼	5-16	⅜	½	⅝	¾	1
Washers....	6¾	5½	4½	3½	3	3	3

In lots less than 200 ℔, ₱ ℔, add ¼¢, 5-B boxes 1¢ to list.

Wedges—

Iron.....₱ ℔ 3½¢
Steel.....₱ ℔ 4 ¢

Weights, Sash—

Solid Eyes.....₱ ton $18@$19

Well Buckets, Galvanized—See Buckets, Well, Galvanized.

Wheels, Well.

8 in., $2.25; 10 in., $2.70; 12 in., $3.23

Wire and Wire Goods—

Iron—

Market.
Br. & Ann., Nos. 0 to 18.....72½%
Cop'd, Nos. 0 to 18.....70%
Galv., Nos. 0 to 18.....62½%
Tin'd, Tinned list Nos. 0 to 18.....62½%
Stone,
Br. and Ann'd, Nos. 16 to 18....72½%
Bright and Ann'd, Nos. 19 to 26.... 75%
Br. and Ann'd, Nos. 27 to 36.....77½%
Tinned.....
Tinned Broom Wire, 18 to 21, ₱ ℔...5¼¢
Galvanized Fence, Nos. 8 and 9.....65%
Annealed Fence, Nos. 8 and 9.....75%
Annealed Grape, Nos. 10 to 14.....75%
Brass, list Jan. 18, 1884.....25%
Copper, list Jan. 18, 1884.....25%
Barb Fence.....See Trade Report
Annealed Wire on Spools.....50%
Malin'sSteel and Tin'd on Spools.....50%
Malin's Brass and Cop. on Spools.....40%
Cast Steel Wire.....50%
Stubs' Steel Wire.....$6.00 to $, 30
Steel Music Wire, Nos. 12 to 30..55¢ ₱ ℔
Picture Wire.....New list 50
Wire Clothes Lines, see Lines.

Bright Wire Goods—

Standard list.....35%

Wire Cloth and Netting.

Painted Screen Cloth, good quality, ₱ 100 sq. ft., $1.60 @ $1.75
Galvanized Wire Netting.....70&10@75%

Wire Rope—See Rope, Wire.

Wrenches—

American Adjustable.....40%
Baxter's Adjustable "S".....40&10@50%
Baxter's Diagonal.....40&10@50%
Coes' Genuine.....50&3%
Coes' "Mechanics".....50&10&3%
Girard Standard.....65&10%
Lamson & Sessions' Engineers'..60&10%
Lamson & Sessions' Standard...70&10%
P. S. & W. Agricultural.... } 75@75&10
Girard Agricultural.... } 75@75&10
Lamson & Sessions' Agric'l.. } 75@75&10
Bemis & Call's
Pat. Combination.....35%
Merrick's Pattern.....35%
Brigg's Pattern.....25%
Cylinder or Gas Pipe.....40&5%
No. 3 Pipe.....40&10%
Aiken's Pocket (Bright).....$6.00, 50&10%
The Favorite Pocket.....₱ doz $4.00, 40%
Webster's Pat. Combination.....25%
Boardman's.....20&10%
Always Ready.....25&5%
Alligator.....50%
Donohue's Engineer.....20&10%
Acme, Bright.....50&2%
Acme, Nickeled.....40&2%
Walker's.....55&3%
Diamond Steel.....55&3%
Cincinnati Brace Wrenches.....25&10%
Tafts' Vise Wrench.....55&10&3%

Wringers, Clothes—

List March 11, 1889, 2% cash.

Wrought Goods—

Staples, Hooks, &c., list Jan. 12, 1886, 80&15@85%

PAINTS, OILS AND COLORS.—Wholesale Prices.

Animal and Vegetable Oils.

Linseed, City, raw..per gal.	62	@	64
Linseed, City, boiled.....	65	@	67
Linseed, Western, raw.....	..	@	60
Lard, City, Extra Winter..	53	@	54
Lard, City, Prime.....	51	@	52
Lard, City, Extra No. 1.....	45	@	46
Lard, City, No. 1.....	42	@	43
Lard, Western, prime.....	51	@	52
Cotton-seed, Crude, prime.	26	@	27
Cotton-seed, Crude, off grades.....	22	@	25
Cotton-seed, Summer Yellow, prime.....	32½@		33
Cottonseed, Summer Yellow, off grades.....	30	@	32
Sperm, Crude.....	67	@	70
Sperm, Natural Spring.....	..	@	68
Sperm, bleached Spring....	..	@	73
Sperm, Natural Winter.....	..	@	78
Sperm, Bleached Winter...	80	@	81
Whale, Crude.....	..	@	..
Whale, Natural Winter.....	..	@	51
Whale, Bleached Winter....	..	@	53
Whale, Extra Bleached.....	55	@	..
Sea Elephant, Bleached Winter.....	60	@	62
Menhaden, Crude, Sound...	19	@	22
Menhaden, Crude, Southern	..	@	..
Menhaden, Light Pressed..	24	@	25
Menhaden, Bleached W'ter.	31	@	32
Menhaden, Extra Bleached	35	@	..
Tallow, City, prime.....	..	@	45
Tallow, Western, prime....	..	@	..
Cocoanut, Ceylon.....	7¾@		8
Cocoanut, Cochin.....	..	@	8½
Cod, Domestic.....	31	@	32
Cod, Foreign.....	33	@	34
Red Elaine.....	31	@	34
Red Saponified..... ₱ ℔	4¾@		5
Bank.....per gal	24	@	..
Straits.....	25	@	..
Olive, Italian, bbls.....	72	@	..
Neatsfoot, prime.....	62½@		75
Palm, prime, Lagos....₱ ℔	6½@		7

Mineral Oils.

Black, 29 gravity, 25 @ 30 cold test.....per gal	8½@		9
Black, 29 gravity, 15 cold test.....	9	@	9½
Black, 29 gravity, summer.	7	@	8
Cylinder, light, filtered....	15	@	20
Cylinder, dark, filtered	14	@	20
Cylinder, dard, st'm refined	10	@	18
Paraffine, 23½ @ 24 gravity.	12½@		13
Paraffine, 25 gravity.....	11½@		12
Paraffine, 28 gravity.....	10½@		11
Paraffine, red, 21 @ 22 gr'ty	..	@	14½
Paraffine, red, 23½@23 gr'ty	12½@		13

Paints and Colors.

Barytes, Prime White..... ₱ ton.	$21.00	@	$22.50
Barytes, Amer. refined...	20.00	@	....
Barytes, Amer. No. 1....	18.00	@	....
Barytes, Amer. No. 2....	16.00	@	....
Barytes, Amer., off-color.	13.00	@	15.00
Blue, Celestial..... ₱ ℔	6	@	8
Blue, Chinese.....	50	@	55
Blue, Prussian.....	25	@	40
Blue, Ultramarine.....	10	@	30
Brown, Spanish	½@		1
Brown, Vandyke, Amer..	3	@	3½
Brown, Vandyke, English	6	@	8
Black, American Drop....	8	@	10
Black, English Drop.....	12	@	14
Black, Frankfort, Drop...	5	@	18
Black, Lamp, common...	12	@	18
Black, Lamp, medium....	19	@	25
Black, Lamp, prime.....	27	@	33
Carmine, No. 40, in bulk.	3.10	@	..
Carmine, No. 40, in boxes or barrels	3.20	@	..
Carmine, No. 40, in ounce bottles.....	4.20	@	..
Chalk, in bulk.... ₱ ton.	2.50	@	2.75
Chalk, in bbls..₱ 100 ℔.	30	@	35
China Clay, English..... ₱ ton.	13.50	@	18.00
China Clay, Southern....10.00		@	12.00
Cobalt Oxide, prep'd....	2.90	@	....
Cobalt Oxide, black.. lots 100 ℔.	2.60	@	....
Cobalt, Oxide, black..... less 100 ℔.	2.65	@	....
Crocus Martus, Engl.₱ ℔.	1¼@		2¼
Crocus, American	1½@		2¼
Green, Paris, in bulk....	14	@	14½
Green, Paris, 170 @ 175 ℔ kegs.....	14½@		15
Green, Paris, small pack.	16	@	21
Green, Chrome, ordinary	8	@	13
Green, Chrome, pure....	22	@	25
Lead, Eng., B.B. white....	9	@	10
Lead, Amn. White, dry or in oil: Kegs, lots less than 1000 ℔..		@	7½
Kegs, lots 1000 ℔ to 5 tons.		@	7
Kegs, lots 5 tons to 12 tons..		@	6¾
Kegs, lots 12 tons and over..		@	6¾
Lead, White, in oil, 25 ℔ tin pails, add to keg price.		@	½
Lead, White, in oil, 12½ ℔ tin pails, add to keg price.....		@	1
Lead, White, in oil, 1 to 5 ℔ assorted tins, add to keg price.		@	2½
Lead, Red, bbls. and ½ bbls....		6½ @	7¼
Lead, Red, kegs.....		6¾ @	7½
Litharge, kegs.....		6¾ @	7½
Litharge, bbls. and ½ bbls.....		6½ @	7¼

TERMS, &C.—Lead and Litharge.—On lots of 1000 ℔ or over, 60 days' time or 2½ % discount for cash if paid within 15 days of date of invoice.

Ocher, Rochelle.....	1.35	@	1¼
Ocher, French Washed.....	1½@		2½
Ocher, German Washed...	1¼@		3
Ocher, American.....	½@		1¼
Orange Mineral, English...	8½@		9½
Orange Mineral, French....	9	@	9¾
Orange Mineral, German ..	8½@		9½
Orange Mineral, American.	8	@	8½
Paris White, English Cliffstone.....	90	@	1.10
Paris White, American.....	70	@	80
Red, Indian, English.....	5½@		7
Red, Indian, American.....	2	@	6
Red, Turkey.....	9	@	14
Red, Tuscan.....	9	@	11
Red, Venetian, American.. ₱ 100 ℔.	1.00	@	1.35
Red, Venetian, Englisa....	1.25	@	1.75
Sienna, Italian, Burnt and Powd.₱ ℔	5	@	6½
Sienna, Ital., Burnt Lumps	1½@		3½
Sienna, Ital., Raw, Powd..	5	@	6½
Sienna, Ital., Raw Lumps..	2	@	3½
Sienna, American, Raw....	1½@		1¾
Sienna, American, Burnt and Powdered.....	1½@		1¾
Talc, French.....	1½@		1¾
Talc, American.....	1	@	1¼
Terra Alba, Fr'ch, ₱ 100 ℔	72½@		80
Terra Alba, English	80	@	85
Terra Alba, American No.1	70	@	75
Terra Alba, American No.2	38	@	40
Umber, Turkey, Bnt. and Powd.. ..... ₱ ℔	3½@		4
Umber, Turkey Bnt.Ln	2½@		3
Umber, Turkey, Raw and Powdered.....	3½@		
Umber Turkey, R'w Lmps	2½@		2¾
Umber, Turkey, Bnt. Amer.	1½@		1¾
Umber, Turkey, R'w Amer.	1½@		1¾
Yellow, Chrome.....	10	@	25
Vermilion, Americ. Lead..	11½@		13
Vermilion, Quicks'er, bulk.	..	@	77½
Vermilion, Quicks'er, bags.	..	@	78½
Vermilion, Quicksilver, smaller pkgs.....	..	@	82½
Vermilion, English Import	85	@	87½
Vermilion, Imitation, Eng.	8	@	25
Vermilion, Trieste.....	87½@		90
Vermilion, Chinese.....	90	@	95
Whiting, Common. ₱ 100 ℔	40	@	45
Whiting, Gliders'.....	50	@	55
Zinc, American, dry.... ₱ ℔	4¾@		5
Zinc, French, Red Seal.....	..	@	8½
Zinc, French, Green Seal..	..	@	8¾
Zinc, French, V. M. X.....	..	@	7
Zinc, Antwerp, Red Seal....	..	@	7¾
Zinc, Antwerp, Green Seal	..	@	8¼
Zinc, German, L. Z. O....	..	@	6¾
Zinc, V. M. in Poppy Oil, G. Seal, lots of 1 ton and over.....	10¾@		11¼
lots less than 1 ton	11	@	11½
Zinc, V. M. in Poppy Oil, Red Seal.....	..	@	..
lots of 1 ton and over....	10	@	10¼
Lots of less than 1 ton....	10¼@		10¾

DISCOUNTS.—French Zinc.—Discounts to buyers of 10- bbl. lots of one or assorted grades. 1 %; 25 bbls, 2 %, 50 bbls, 4 %. No discount allowed on less than bbl. lots.

Colors in Oil.

Blue, Chinese..... ₱ ℔	35	@	40
Blue, Prussian.....	20	@	45
Blue, Ultramarine.....	12	@	18
Brown, Vandyke..... ...	7	@	12
Green, Chrome.....	8	@	13
Green, Paris.....	16	@	18½
Sienna, Raw.....	7	@	13
Sienna, Burnt.....	7	@	13
Umber Raw.....	7	@	10
Umber, Burnt	7	@	10

Glue.

Low Grade..... ₱ ℔	8	@	10
Cabinet.....	12	@	14
Medium White.....	13	@	15
Extra White.....	17	@	20
French.....	10	@	22½
English.....	10	@	15
Irish.....	12	@	15

CURRENT METAL PRICES.

OCTOBER 8, 1890.

The following quotations are for small lots. Wholesale prices, at which large lots only can be bought, are given elsewhere in our weekly market reports.

IRON AND STEEL.

Bar Iron from Store.

Common Iron:	
¾ to 2 in. round and square.. 1 to 6 in. x ⅝ to 1 in.....	₩ lb 2.00 @ 2.10¢
Refined Iron:	
¾ to 2 in. round and square.. 1 to 4 in. x ⅝ to 1½ in.....	₩ lb 2.10 @ 2.30¢
4½ to 6 in. x ⅝ to 1 in.....	₩ lb 2.30 @ 2.50¢
1 to 6 in. x ¼ and 5-16	₩ lb 2.30 @ 2.50¢
Rods—⅝ and 11-16 round and sq..	₩ lb 2.20 @ 2.40¢
Bands—1 to 6 x 3-16 to No. 12.....	₩ lb 2.40 @ 2.60¢
"Burden Best" Iron, base price..	₩ lb 2.90 @ ....¢
Burden's "H. B. & S." Iron, base price.....	₩ lb 2.70 @ ....¢
"Ulster".....	₩ lb 2.90 @ ....¢
Norway Bars	3.90 @ ....¢
Norway Shapes	4.90 @ ....¢

Merchant Steel from Store.

	Per pound.
Open-Hearth and Bessemer Machinery, Toe Calk, Tire and Sleigh Shoe, base price in small lots.....	2¾¢
Best Cast Steel, base price in small lots	8 ¢
Best Cast Steel Machinery, base price in small lots.....	5¢

Sheet Iron from Store.

	Common American.	R. G.	Cleaned.
10 to 16.....	₩ lb 3.00 @ 3.00¢	3.50 @ .....¢	
17 to 20.....	₩ lb 3.25 @ 3.25¢	3.50 @ 3.75 ¢	
21 to 24.....	₩ lb 3.35 @ 3.35¢	3.75 @ .....¢	
25 and 26.....	₩ lb 3.45 @	3.75 @ .....¢	
27.....	₩ lb 3.55 @ 3.63¾¢	4.00 @ .....¢	
28.....	₩ lb 3.75 @ .. ..¢	4.25 @ .....¢	
	B. B.		2d qual.
Galv'd, 14 to 20,	₩ lb, 5.00 @ ...	4.75½ @ .....¢	
Galv'd, 21 to 24,	₩ lb, 5.37½ @ ...	5.12½ @ .....¢	
Galv'd, 25 to 26,	₩ lb, 5.75 @ ...	5.50 @ .....¢	
Galv'd, 27.....	₩ lb, 6.12½ @ ...	5.85½ @ .....¢	
Galv'd, 28.....	₩ lb, 6.50 @ ..	6.23 @ .....¢	
Patent Planished.....	₩ lb A 10¢	B, 9¢	
Russia.....	₩ lb 9½¢ @ 10¢		
American Cold Rolled B. B.....	₩ lb 5¢ @ 7¢		
Craig Polished Sheet Steel.....	₩ lb, 8½¢		

English Steel from Store.

Best Cast	₩ lb 15 ¢
Extra Cast	₩ lb 16½ @ 17 ¢
Swaged, Cast.....	₩ lb 16 ¢
Best Double Shear.....	₩ lb 15 ¢
Blister, 1st quality.....	₩ lb 12 ¢
German Steel, Best.....	₩ lb 10 ¢
2d quality.	₩ lb 9 ¢
3d quality	₩ lb 8 ¢
Sheet Cast Steel, 1st quality.....	₩ lb 15 ¢
2d quality.....	₩ lb 14 ¢
3d quality.....	₩ lb 12½¢
R. Mushet's "Special"	₩ lb 48 ¢
" " "Titanic".....	₩ lb 20 ¢

METALS.

Tin.

	Per lb
Banca, Pigs.....	24⅝¢
Straits, Pigs.....	24¼¢
Straits in Bars	27 ¢

Tin Plates.

Charcoal Plates.—Bright.

		Per box.
Melyn Grade.....IC, 10 x 14..	@	$6.50
" " .....IC, 12 x 12..	@	6.75
" " .....IC, 14 x 20..	@	6.50
" " .....IC, 20 x 28..	@	13.25
" " .....IX, 10 x 14..	@	8.00
" " .....IX, 12 x 12..	@	8.25
" " .....IX, 14 x 20..	@	8.00
" " .....IX, 20 x 28..	@	16.00
" " .....DC, 12½ x 17..	@	6 00
" " .....DX, 12½ x 17..	@	7.50
Jalland Grade.....IC, 10 x 14..	@	6.50
" " .....IC, 12 x 12..	@	6.75
" " .....IC, 14 x 20..	@	6.40
" " .....IX, 10 x 14..	@	7.65
" " .....IX, 12 x 12..	@	7.90
" " .....IX 14 x 20.	@	7.65
Allaway Grade.....IC, 10 x 14..	@	5.80
" " .....IC, 12 x 12..	@	5.95
" " .....IC, 14 x 20..	@	5.80
" " .....IC, 20 x 28..	@	11.50
" " .....IX, 10 x 14..	@	6.97
" " .....IX, 12 x 12..	@	7.10
" " .....IX, 14 x 20..	@	6.95
" " .....IX, 20 x 28..	@	14.00
" " ...DC, 12½ x 17.. ...	@	5.45
" " ..DX, 12½ x 17.. 6.00	@	6.45

Coke Plates.—Bright.

Steel Coke.—IC, 10 x 14, 14 x 20,.	@	$5.60
10 x 20..	@	7.75
20 x 28.. ...	@	11.25
IX, 10 x 14, 14 x 20..	@	6.50
BV Grade.—IC, 10 x 14, 14 x 20.. ...	@	5.60

Charcoal Plates.—Terne.

Dean Grade.—IC, 14 x 20..	@	$5.30
20 x 28.	@	10.60
IX, 14 x 20.....	@	6.00
20 x 28.....	@	12 00
Abecarne Grade.—IC, 14 x 20...	@	5.00
20 x 28...	@	10.25
IX, 14 x 20.... ...	@	6.00
20 x 28..	@	12 00

Tin Boiler Plates.

IXX, 14 x 26.....112 sheets.....	@	$13.50
IXX, 14 x 28.....112 sheets....	@	13.75
IXX, 14 x 31... ....112 sheets	@	15.25

Copper.

DUTY: Pig, Bar and Ingot, 4¢; Old Copper, 3¢ ₩ lb. Manufactured (including all articles of which Copper is a component of chief value), 45 % ad valorem.

Ingot.

Lake.....	@ 17½¢
Baltimore Grade.....	@ 15 ¢

Sheet and Bolt.

Prices adopted by the Association of Copper Manufacturers of the United States, June 27, 1890, being quotations for all sized lots.

Not wider than	Not longer than	And longer than	Weights per square foot and prices per pound. Over 64 oz.	32 to 64 oz.	16 to 32 oz.	14 to 16 oz.	12 to 14 oz.	10 to 12 oz.	8 to 10 oz.	Less than 8 oz.
30	72		25	25	25	26	27	28	31	33
30		72	25	25	25	26	28	30	34	....
36	96		25	25	25	27	29	33	36	....
36		96	25	25	26	28	30	34	38	....
48	96		25	25	27	29	31	35	....	....
48		96	25	25	28	30	32	36	....	....
60	96		25	25	30	32	37	....	....	....
60		96	25	26	31	....	....	....	....	....
84	96		26	27	....	....	....	....	....	....
84		96	27	28	....	....	....	....	....	....
Over 84 in. wide			28	30	....	....	....	....	....	....

All Bath Tub Sheets.....	16 oz.	14 oz.	12 oz.	10 oz.
Per pound.....	$0.27	0.29	0 31	0.35

Bolt Copper, ¾ inch diameter and over, per pound..... 25¢

Circles, 60 inches in diameter and less, 3 cents per pound advance over lowest prices of Sheet Copper of the same thickness.

Copper Bottoms, Pits and Flats.

	Per pound.
14 ounce to square foot and heavier.....	29¢
12 ounce and up to 14 ounce to square foot.....	30¢
10 ounce and up to 12 ounce.....	32¢

Circles less than 8 inches diameter 2 cents per pound additional.

Circles over 13 inches diameter are not classed as Copper Bottoms.

Tinning.

Tinning sheets on one side, 10, 12 and 14 x 48 each.....	8¢
Tinning sheets on one side, 30 x 60 each	30¢
For tinning boiler sizes, 9 in. (sheets 14 in. x 60 in.), each.	15¢
For tinning boiler sizes, 8 in. (sheets 14 in. x 56 in.), each	12¢
For tinning boiler sizes, 7 in. (sheets 14 in. x 52 in.) each.....	10¢
Tinning sheets on one side, other sizes, per square foot.....	2½¢

For tinning both sides double the above prices.

Planished Brass and Copper.

14 x 48.

14 and 16 oz. and heavier..31¢. By the case...30¢ ₩ lb
12 oz. and lighter.....33¢. By the case...32¢ ₩ lb
24 x 48 and 30 x 60.
14 and 16 oz. and heavier..44¢. 12 oz.....37¢ ₩ lb

Seamless Brass and Copper Tubes.

O. G.	N. G.	⅜	½	⅝	¾	⅞	1	1¼
8-14	6-12	39	35	32	31	30	29	26
15	13	40	35	33	32	31	30	27
16	14	41	36	34	33	32	31	27
17	15	42	37	35	32	33	32	28
18	16	44	38	36	34	33	32	29
19	17	45	39	37	36	35	34	31
20	18-19	46	41	39	38	37	36	33
21	20	48	43	41	40	39	38	36
22	21	50	44	42	41	40	39	38
23	22	52	46	44	43	42	41	41
24	23	55	48	45	45	43	42	43
25	24	58	51	48	47	46	45	47

Copper Bronze and Gilding Tube, 3¢ ₩ lb additional.

Brazed Brass Tubing. (To No. 20, inclusive.

Above 5-16 inch to 3 inch, inclusive	35¢
Plain, above 3 inch.....	45¢
Plain, 5-16 inch.....	45¢
Plain, ¼ inch.....	60¢
Plain, 3-16 inch.....	$1.00
Plain, ⅛ inch.....	1.50
Fancy Tubing, Brass, to No. 20, inclusive.....	45¢ ₩ lb
Bronze Tubing, 3¢ ₩ lb more than Brass.	
Discount from list.....	25 @ ... %

Roll and Sheet Brass.

Discount from list..... 20 %

High Brass Rods.

Over 1 inch diameter..	29¢
¼ inch to 1 inch diameter, both inclusive.....	30¢
No. 8 and less than ¼ inch diameter.....	32¢
Smaller than No. 8.....	33¢

Hexagon, Octagon and Square, 2¢ ₩ lb advance over Round Rods.

Spelter.

Duty: Pig, Bars and Plates, $1.50 ₩ 100 lb.

Western Spelter	6¼¢
"Bertha"	8¢

Zinc.

Duty; Sheet, 2½¢ ₩ lb.

600 lb casks.....	6¼¢
Per lb	7¼¢

Lead.

Duty: Pig, $2 ₩ 100 lb. Old Lead, 2¢ ₩ lb. Pipe and Sheets, 3¢ ₩ lb.

American	5¾¢
Bar.....	6½¢
Pipe, subject to trade discount....	8¢
Tin-Lined Pipe, subject to trade discount....	10¢
Block Tin Pipes, subject to trade discount.....	45¢
Sheet, subject to trade discount.....	83¼¢

Solder.

½ @ ½ (Guaranteed)...	16¼¢
No. 1.....	15¢
Extra Wiping.....	11¾¢ @ 13¢

The prices of the many other qualities of Solder in the market indicated by private brands vary according to composition.

Antimony.

Cookson.....	₩ lb 23¢
Hallett's.	" 21¢

ALUMINUM.

Prices in Ingots.

$2.00 ₩ lb in lots of 1000 lb and over.
$2.25 ₩ lb in lots of 500 lb and over.
$2.50 ₩ lb in lots of 100 lb and over.

Prices Per Pound on Rolled Sheets.

(Brown & Sharpe, Standard Gauge.)

Wider than. ..... / And including.....	2 in. / 10 in.	10 in. / 14 in.	14 in. / 18 in.	18 in. / 22 in.	22 in. / 24 in.
Up to No. 20 inclusive...	$2.50	$2.60	$2.80	$3.00	$3.20
Nos. 21, 22, 23 and 24....	2.60	2.70	2.90	3 10	3.30
Nos. 25 and 26.....	2.70	2.80	3.00	3.20	3.40
Nos. 27 and 28.....	2.80	2.90	3.10	3.30	3.50

Sheets, thinner than No. 28 gauge and wider than 24 inches, special prices not less than $5 per pound.
Add 30 cents per pound for sheets cut to particular widths and lengths.
Sheets rolled to .001 in. and under, 50 cents per ounce.
Leaf in books, 20 cents per book; $2 per pack of 10 books, sheets 5 x 5 inches.

Aluminum Tubing.

From $4 per pound upward, according to size and thickness of walls.

Aluminum Castings.

From 50 cents upwards per pound extra over the cost of the metal in ingots, according to the number wanted, weight, the difficulty of casting, cost of patterns, &c.

Aluminum Wire in Coils.

(Brown & Sharpe, Standard Gauge.)

	Per lb
All numbers up to No. 24 (.064 in.) inclusive.....	$3.00
Nos. 15 (.05706 in.) to 22 (.02534 in.) inclusive....	3.25
Nos. 23 (.02571 in.) and 24 (.0201 in.) inclusive...	3.50
Nos. 25 (.0179 in.) and 26 (.01594 in.) inclusive....	3.75
Nos. 27 (.014195 in.) and 28 (.012641 in.) inclusive	4.00
Nos. 29 (.011257 in.) and 30 (.010023 in.) inclusive	4.25
No. 31 (.008928 in.).....	4.50
No. 32 (.00795 in.).....	4.75
No. 33 (.00708 in.).....	5.00
No. 34 (.00630 in.).....	5.25
No. 35 (.00561 in.).....	5.75
No. 36 (.00500 in.).....	6.25
No. 37 (.00445 in.).....	7.00
No. 38 (.003965 in.).....	8.50
No. 39 (.003531 in.).....	12.00
No. 40 (.003144 in.).....	16.00

Spooling, on 1-pound spools, 15 cents per pound extra
Spooling, on 10-pound spools, 5 cents per pound extra

Old Metals.

(Prices Paid in New York.)

Heavy Copper.....	₩ lb 12 ¢
Light Copper.....	₩ lb 11 ¢
Heavy Brass.....	₩ lb 10 ¢
Light Brass.....	₩ lb 8 ¢
Lead.....	₩ lb 4 ¢
Tea Lead.....	₩ lb 3½¢
Zinc.....	₩ lb 3 ¢
No. 1 Pewter.....	₩ lb 16 ¢
No. 2 Pewter.....	₩ lb 8 ¢
Wrought Scrap Iron.....	₩ gross ton $19.00
Heavy Cast Scrap.....	₩ gross ton 12.00
Stove Plate Scrap.....	₩ gross ton 8.00
Burnt Iron.....	₩ gross ton 6.00